BENZENE AND TOLUENE SOURCE AREA INVESTIGATION

Industri-Plex Site
Woburn, Massachusetts

January 8, 1998

Prepared for:

Industri-Plex Site Remedial Trust
36 Commerce Way
Woburn, Massachusetts

Prepared by:

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January 13, 1998

BY HAND

Joseph LeMay
Remedial Project Manager
United States Environmental Protection Agency
Region I
90 Canal Street
Boston, MA 02203

Re: Benzene/Toluene Source Area Investigation Report
Commerce Way/Atlantic Avenue; Industri-Plex Site

Dear Mr. LeMay:

On behalf of the Industri-Plex Site Remedial Trust ("ISRT"), I am pleased to provide EPA with nine (9) copies of the Benzene and Toluene Source Area Investigation Report for the Commerce Way/Atlantic Avenue area, prepared by Roux Associates, in accordance with the work plan approved by EPA on November 7, 1997. By copy of this letter, I am also sending a copy of the Report to Dan Winograd. As summarized at page 12 of the Report, the investigation indicates that, while toluene was detected at depth in the groundwater, no ongoing sources of benzene or toluene were detected and the toluene was detected below the depths at which excavation for the Commerce Way extension and the new I-93 Interchange will take place.

If you have any questions concerning the report, please do not hesitate to call me or Mike Light.

Very truly yours,

Laurie Burt

Enclosure
cc: Daniel Winograd, Esq., EPA (w/enclosure)
D. Michael Light, ISRT (w/o enclosure)

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A. Soil Gas Survey Report Prepared by Pine & Swallow Associates, Inc.
B. Geophysical Survey Report Prepared by Geophysics GPR International, Inc.
C. BTEX-in-Soil Test Kit Calculation Forms
D. Analytical Laboratory Report Prepared by American Environmental Network
E Ground-Water Analysis Report Prepared by O'Reilly, Talbot & Okun Associates, Inc.

1.0 INTRODUCTION

A benzene and toluene source area investigation was conducted in the vicinity of the intersection of Commerce Way and Atlantic Avenue (Source Area Investigation) at the Industri-Plex Site (Site) during November and December 1997. The investigation was conducted by Roux Associates, Inc. and O'Reilly, Talbot and Okun Associates, Inc. on behalf of the Industri-Plex Site Remedial Trust (ISRT), and was performed in accordance with a work plan dated November 7, 1997 (Roux Associates 1997a) that was approved by the United States Environmental Protection Agency (USEPA) on November 7, 1997. Due to the impending redevelopment and road construction activities scheduled to begin in the area, the investigation was conducted as a fast-track study to generate screening level data from which to make prompt decisions regarding potential response actions.

The Source Area Investigation was focused around former monitoring well OW-16, which had been located northeast of the intersection of Commerce Way and Atlantic Avenue, within the southeast portion of the East-Central Hide Pile (Figure 1). From the time of its installation during the Phase 1 Remedial Investigation in 1983 until the time of its abandonment in 1993, OW-16 consistently exhibited toluene concentrations of 30,000 to 35,000 micrograms per liter (µg/L). OW-16 was screened from 15 to 35 ft beneath land surface. Depth to water at the former location of OW-16 is approximately 5 ft.

As part of the Supplemental Source Investigation (SSI) conducted in late 1996 and early 1997, a ground-water sample was collected from Geoprobe Point GW-3, located in the vicinity of former monitoring well OW-16, at a depth of 23 ft below land surface. This sample contained toluene at a concentration of 4 µg/L. Based upon these findings, the SSI Report concluded that toluene concentrations appeared to have declined significantly since the early 1990s, when GSIP Phase 1 and 2 were completed, and that these results suggested either a reduction in the strength of the toluene source in that area or a reduction in the leaching of the source area due to Site remedial measures completed since the GSIP Phase 1 and 2 (i.e., capping of the East-Central Hide Pile). However, the SSI Report cautioned that, given the limited data set developed during the SSI, the apparent dissipation of the toluene "hot spot" needed to be confirmed.

Benzene had never been detected in OW-16, nor was benzene detected in ground-water sample GW-3 during the SSI. Nonetheless, benzene was included in this Source Area Investigation at the request of USEPA based on their assertion that benzene had been detected in ground water entering a test pit excavated during a previous investigation in the same general area.

Based upon the historical data from OW-16 and the results of the SSI, the objective of the Source Area Investigation was to further investigate the potential for a continuing source of toluene or benzene in the vicinity of former monitoring well OW-16.

The subsequent sections of this report present the scope of work and the results of the Source Area Investigation.

2.0 SCOPE OF WORK

As presented in the USEPA-approved work plan, the field work completed for the Source Area Investigation included the following tasks:

- Task 1 - Soil Gas Survey;
- Task 2 - Geophysical Survey;
- Task 3 - Soil Sampling; and
- Task 4 - Ground-Water Sampling.

In addition, test pits were excavated at four locations based upon the results of Task 2 - Geophysical Survey. Descriptions of each of the above tasks, as well as the test pit excavation task, are provided below.

2.1 Task 1 - Soil Gas Survey

A soil gas survey was conducted on November 10 and 11, 1997, by Pine & Swallow Associates, Inc. (PSA) of Groton, Massachusetts, under the oversight of a Roux Associates, Inc. field geologist. Soil gas samples were collected at the 39 locations shown in Figure 2, with the exception of SG-22. As shown, the sample locations were based upon a 50-foot grid spacing over the 300 foot by 300 foot area specified in the work plan. Sample locations were modified as necessary to accommodate surface features (e.g., streams, wetlands, etc.). The soil gas samples were collected from a depth of 2 to 4 feet below land surface and analyzed in the field for benzene and toluene using a gas chromatograph (GC). There was no soil gas sample collected at SG-22 due to the presence of ground water at a depth of less than 3 ft. A sample of the ground water was collected and analyzed for benzene and toluene using the GC. There were no detections of either benzene or toluene in soil gas or ground water at concentrations exceeding the practical quantitation limit of 1 part per billion. Details regarding sampling and analysis methods and quality assurance/quality control (QA/QC) procedures are provided in Appendix A.

2.2 Task 2 - Geophysical Survey

A geophysical survey was performed using magnetometry and ground penetrating radar (GPR) technology. The survey was conducted from November 12 to 26, 1997, by Geophysics GPR International, Inc., of Needham Heights, Massachusetts, under the oversight of a Roux Associates, Inc. field geologist. As discussed in the USEPA-approved work plan, the magnetometer survey was to be conducted first to identify potential ferromagnetic anomalies within soil gas anomaly areas, and then the GPR survey was to be performed to further investigate the source(s) of any ferromagnetic anomalies identified using the magnetometer. As noted above, there were no detections of benzene or toluene during the soil gas survey; therefore, the magnetometer survey was conducted across the entire accessible portion of the initial 300 foot by 300 foot sample grid area. In addition, the magnetometer survey was expanded approximately 250 feet southward at the request of USEPA to include an additional area of reported historical detections of benzene and toluene in ground water. The GPR survey was also conducted across the entire accessible portion of the initial 300 foot by 300 foot area of investigation. Due to the fact that the GPR antenna is designed to be dragged continuously along the ground surface, rather than carried from point to point like the magnetometer, the area accessible to GPR was slightly less than the area accessible to the magnetometer. In order to enable resolution of individual anomalies which could be caused by buried drums or tanks, the magnetometer and GPR surveys were conducted along parallel transects spaced every 5-feet and 3-feet, respectively. Details regarding the geophysical survey methods are provided in Appendix B.

2.3 Task 3 - Soil Sampling

Soil boring and sampling was conducted from November 18 through November 21, 1997, using a Geoprobe™ rig at the 29 locations shown in Figure 3, with the exception of SB-EF4, SB-F3, SB-G3 and SB-I2 (these four locations were sampled only for ground water as described in Section 2.4). The work plan specified that soil boring and sampling would be performed using a Geoprobe™ in the areas exhibiting soil gas and geophysical anomalies. As noted in Section 2.1, there were no soil gas anomalies. Therefore, the 25 soil sampling locations were selected according to rationale presented below.

- The initial phase of soil boring and sampling included 10 locations based on a 100 ft grid spacing throughout the northern two-thirds of the sample grid area (the southern area was largely inaccessible to the Geoprobe™). These boring locations include SB-A2, SB-A4, SB-C2, SB-C4, SB-C6, SB-E2, SB-E4, SB-E6, SB-G2 and SB-G4.

- In response to the request of USEPA's field representatives, ten soil sampling locations were added in three specific areas: the area of a former excavation on the west bank of the Aberjona River where toluene had been detected in ground water (soil borings SB-M2 and SB-FG2); the area of former monitoring well OW-16 (soil borings SB-E3 and SB-F2); and within the area earmarked for construction of a storm water retention basin as part of road construction activities (SB-I4, SB-I6, SB-K4, SB-L6, SB-M3 and SB-M5).

- Based upon the results of the magnetometer survey, which showed numerous magnetic anomalies in the central and eastern portion of the initial 300 by 300 foot grid area, five more soil sampling locations (SB-D4, SB-D6, SB-D7, SB-E5, and SB-E7) were added in this area to investigate the anomalies. In addition, location SB-E6 was resampled.

Soil samples were collected continuously down to the water table or to the point of Geoprobe™ refusal at each location. The samples were collected with a core sampler equipped with a single-use acetate liner. Upon retrieval the liner was sliced open and the sample immediately collected from the center portion of the soil. Forty-two samples were screened in the field for the presence of benzene and toluene using MADEP-approved ENSYS Enviroguard™ BTEX-in-soil field test kits. Calculation forms for the test kits are provided in Appendix C. Five soil samples were sent to the American Environmental Network (AEN) laboratory located in North Billerica, Massachusetts for confirmatory analyses. These samples were analyzed for BTEX using USEPA Methods 8240 and 8020. The laboratory reports for the five samples are provided in Appendix D.

2.4 Task 4 - Ground-Water Sampling

Shallow ground-water samples were collected from approximately 2 feet below the water table at all soil boring locations with the exception of five locations where refusal was encountered prior to reaching the water table (locations SB-D6, SB-D7, SB-E5, SB-E6 and SB-E7). In response to the request of USEPA's field representatives, four additional sampling locations were added

(SB-EF4, SB-F3, SB-G3 and SB-E2). At these four locations, as well as at locations SB-M2, SB-E2 and SB-E3, deeper ground-water samples were collected from depths ranging from 5 to 20 feet beneath the water table.

A total of 29 ground-water samples were analyzed in the field for benzene and toluene using a GC. The samples collected on November 18, 1997, were analyzed by PSA, while the samples collected from November 19 through November 21, 1997, were analyzed by O'Reilly, Talbot & Okun Associates, Inc. (OTO) of Springfield, Massachusetts. The analytical methods used by PSA and OTO are described in Appendices A and E, respectively. Three ground-water samples were sent for confirmatory analysis to AEN. These samples were analyzed for BTEX using USEPA Method 8020. The laboratory reports for these three samples are provided in Appendix D.

2.5 Test Pit Excavations

Four test pits were excavated at the locations shown in Figure 4. These locations were selected based upon the results of the geophysical survey which indicated the potential presence of cylindrical objects such as drums or USTs.

3.0 SOURCE AREA INVESTIGATION RESULTS

The results of the Source Area Investigation are presented in the following sections.

3.1 Soil Gas Survey Results

As noted in Section 2.1 there were no detections of benzene or toluene in any of the 38 soil gas samples. Appropriate QA/QC procedures were followed during the survey to ensure that the analytical equipment was functioning correctly. Appendix A provides descriptions of the soil gas analysis and QA/QC procedures, and a tabular summary of soil gas results.

The USEPA's field representative expressed concern that rain events just prior to implementation of the soil gas survey could have prevented the effective use of this technology. However, Roux Associates believes that the soil gas results are valid because toluene was detected only at depths greater than five feet below the water table. Roux Associates does not expect toluene to be present in soil gas, since no toluene was present in the uppermost part of the saturated zone.

3.2 Geophysical Survey Results

The results of the geophysical survey are summarized below. Additional details and maps of the geophysical survey results are provided in Appendix B.

The magnetometer survey results for the central and eastern portions of the study area revealed numerous anomalies that could not be attributed to visible surface features or to known subsurface features. These anomalies are shown in Figure 4A (Appendix B). The anomalies designated with an "A" in Figure 4A (Appendix B) are the anomalies which the geophysicist considered to have some potential to be attributed to the presence of a buried drum(s) or UST. The magnetic anomalies measured in the southern and western parts of the study area were attributed to the numerous ferrous objects, such as car parts, construction debris, and discarded household items, observed in these areas. Additionally, the geophysicist indicated that a number of anomalies in the southern portion of the study area were associated with bedrock exposures.

Figure 4B (Appendix B) provides the interpretation map for the GPR survey. The anomalies designated with an "A" in Figure 4B (Appendix B) are the GPR anomalies which the geophysicist considered to have some potential to be attributed to the presence of a buried drum(s) or UST. It is important to note that correlation of maps 4A and 4B indicates that none of the anomalies designated with an "A" in Figure 4A yielded a GPR anomaly indicative of a buried drum or tank. Thus, it is highly unlikely that any such features are present at those locations.

In order to facilitate comparison of the magnetometer and GPR survey anomalies with the results from other Source Area Investigation tasks, the anomalies designated with an "A" in Figures 4A and 4B (Appendix A) have been superimposed onto the Source Area Investigation sampling grid (Figure 4).

3.3 Soil Boring and Sampling Results

The results of the soil boring and sampling are summarized on Table 1. These results include lithologic descriptions for all soil samples collected, photoionization detector (PID) readings and BTEX test kit and laboratory analytical results (where applicable). A discussion of this data is provided below.

Sample Descriptions: The soil underlying the sampling grid area is comprised predominantly of fine to medium grained sand, with lesser amounts of silt and fine to coarse gravel. The soil from 0 to 2 feet was typically brown to orange-brown in color, while deeper soils typically ranged from dark brown to grey and black in color. Strong odors were only noted in the soil samples from borings SB-A2 and SB-C2, both within the capped portion of the East-Central Hide Pile. These odors were more typical of the decaying organic matter present in the capped hide pile, rather than an aromatic hydrocarbon odor that would be associated with benzene or toluene. Slight odors were also associated with the samples from borings SB-M2 and SB-D4.

PID Readings: The PID readings obtained from the screening of soil samples ranged from 1.1 parts per million (ppm) to a maximum of 3.1 ppm (Table 1). Based on our experience at petroleum spill sites, these PID readings are one to two orders of magnitude lower than would be expected if the soil had contained benzene or toluene at "source area" concentrations.

Test Kit Results: The BTEX-in-soil test kit results ranged from less than 1 ppm at several locations, to a maximum of 60 ppm at SB-M3, 2 to 4 ft (Table 1). Twenty-five of the 42 samples exhibited BTEX-in-soil test kit results of less than 2 ppm; 11 of the 42 were between 2 and 10 ppm; and six of the 42 test kit results were greater than 10 ppm. The table below provides a comparison of the test kit results with the laboratory results for the five samples sent for confirmatory analysis.

		Laboratory Analytical Results				
Sample ID	BTEX Test Kit Result (ppm)	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	Total BTEX (µg/kg)
SB-E4/4-6	12.5	<1	<2	<2	<2	ND
SB-E6/2-4	1.3	<1	3	<2	2	5
SB-F2/2-4	1.4	<1	<2	<2	2	2
SB-F2/4-6	30	<1	<2	<2	<2	ND
SB-M2/4-6	12.5	<1	<2	<2	<2	ND

The above table indicates that the BTEX-in-soil test kits yielded false positive BTEX detections and overestimated the BTEX concentrations by several orders of magnitude. The ppm-range concentrations determined by the test kits are not consistent with the field observations (i.e., no aromatic hydrocarbon odors) nor the soil gas survey results (i.e., benzene and toluene were not detected). A possible explanation for these false positives and overestimated BTEX concentrations is the potential presence of other organic matter or non-target compounds within the soil samples.

Borings at Geophysical Anomalies: As discussed in Section 3.2, there were numerous magnetometer anomalies throughout the northeast portion of the Peninsula Area. Soil Borings SB-D4, SB-D6, SB-D7, SB-E5 and SB-E7 were performed to investigate the soil conditions in this area. The shallow refusal depth and unsaturated soil conditions at each of these locations is indicative of the presence of shallow bedrock throughout this area, which is consistent with the observation of numerous bedrock outcrops. Based upon these data, as well as the absence of any impacted soil, the geophysical survey anomalies in the northeast portion of the Peninsula Area are attributed to the presence of the shallow bedrock.

3.4 Ground-Water Sampling Results

The locations and depths of ground-water samples collected during the Source Area Investigation, as well as the analytical results for toluene in the ground-water samples, are shown in Figure 3. Benzene was not detected in any of the ground-water samples. The results for toluene are discussed below.

Toluene was not detected in any of the shallow ground-water samples (i.e., those collected within five feet of the water table). Toluene was detected in 5 of the 9 ground-water samples collected from depths exceeding five feet beneath the water table (locations SB-G3, SB-F3, SB-M2, SB-E2 and SB-I2 in Figure 3). Concentrations ranged from 50 µg/L in SB-I2 (14 feet below land surface) to 20,000 µg/L at SB-G3 (13 feet below land surface). The table below provides a comparison of the field GC results with the laboratory results for the three samples sent for confirmatory analysis.

Sample ID	Benzene - Field GC	Benzene - Lab	Toluene - Field GC	Toluene - Lab
GW-C2	<1	<25	1	<25
GW-EF4	<25	<1	<25	<1
GW-F3	<25	<200	13,000	19,000

The above results indicate general agreement between the field GC and off-site laboratory results.

3.5 Test Pit Observations

Test pits were excavated at the four locations shown in Figure 4. From north to south, these excavations revealed:

- a 2-inch PVC well broken below grade and a piece of metal debris;
- a reinforced concrete drainage vault;
- a small bundle of wire; and
- the sewer connection for the trailer compound formerly located in the area.

Inspections of the test pits and the materials encountered indicate that none of these represent the source of the toluene.

4.0 SUMMARY OF FINDINGS AND CONCLUSIONS

- The results of the soil gas survey, magnetometer survey, ground-penetrating radar survey, soil sampling and analysis, ground-water sampling and analysis, and test pit excavation, combined with the results of prior investigations, conclusively demonstrate that the toluene detected in ground water north of the intersection of Commerce Way and Atlantic Avenue is not the result of leakage from buried drums or tanks and that there is no ongoing source of toluene in the study area.

- The toluene "hot spot" is currently located immediately north of the intersection of Commerce Way and Atlantic Avenue, just slightly south (approximately 50 ft) of its 1991/1992 location.

- Toluene concentrations in the "hot spot" range from 2,400 to 20,000 µg/L at depths ranging from 13 to 25 feet below land surface. Consequently, the "hot spot" is below the depth of the excavations needed to construct the Commerce Way extension and the I-93 interchange.

Respectfully Submitted,

ROUX ASSOCIATES, INC.

Andrew Baris
Principal Hydrogeologist

Lawrence McTiernan
Principal Hydrogeologist/
Project Manager

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Principal Hydrogeologist/
Project Principal

TABLES

Table 1. Summary of Geoprobe™ Soil Boring and Sampling Data for the Benzene and Toluene Source Area Investigation, Intersection of Commerce Way and Atlantic Avenue, Industri-Plex Site, Woburn, Massachusetts

					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-C2	11/18/97	0 - 2	Grey F-M SAND, little F-C Gravel (fill), Dry to Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Orange-brown to light brown F-M SAND, Moist	<1.3	0	—	Slight odor
	11/18/97	4 - 6	Brown to light brown to grey SAND, little F-M Gravel; Moist	<1.3	1.3	—	Slight odor
	11/18/97	6 - 8	Brown to light brown and grey F-M SAND, followed by dark brown to black F-M SAND; Very Moist	<1.3	0	—	Strong odor
SB-A2	11/18/97	0 - 2	Grey F-M SAND; little F-C Gravel; Dry to Slightly Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Brown-orange to light brown F-M SAND; Moist	<1.3	—	—	Slight odor
	11/18/97	4 - 6	Brown to light grey SAND, little F-M Gravel; Moist	<1.3	---	---	Slight Odor
	11/18/87	6 - 8	Dark brown to grey to black SAND, little F-M Gravel; Very Moist	<1.3	—	—	Strong odor, fibrous material (hide)
SB-E2	11/18/97	0 - 2	Grey F-M SAND, little Gravel; Dry to Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Brown to orange F-M SAND, little F-M Gravel; Moist	<1.3	1.15	—	No odor
	11/18/97	4 - 6	Brown to light brown to grey SAND, Gravel (F-C) at lower level; Moist	<1.3	2.3	---	No odor
SB-G2	11/18/97	0 - 2	Grey F-M SAND, little Gravel; Dry to Moist	<1.3	---	---	No odor
	11/18/97	2 - 4	Brown to light brown to orange to grey SAND, little F-C Gravel; Moist	<1.3	2.5	---	Hit black plastic object
SB-G4	11/18/97	0 - 2	Brown F-M SAND, some Silt, little F-C Gravel; Moist to Wet	<1.3	1.1	---	No odor
	11/18/97	2 - 4	Brown F-M SAND, some Silt, little F-C Gravel; Wet at 4 ft	<1.3	1.45	—	Slight odor

Table 1. Summary of Geoprobe™ Soil Boring and Sampling Data for the Benzene and Toluene Source Area Investigation, Intersection of Commerce Way and Atlantic Avenue, Industri-Plex Site, Woburn, Massachusetts

					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-F4	11/18/97	0 - 2	Orange-brown to brown F-M SAND, little Silt, little F-C Gravel; Moist	<1.3	---	---	No odor (fill)
	11/18/97	2 - 4	Brown to dark brown F-M SAND, some Silt, little F-C Gravel; Moist	2.5	2.4	---	Geotextile barrier at 2 ft bls, no odor
	11/18/97	4 - 6	Dark brown to black mottled F-M SAND, some Silt, little F-M Gravel; Moist	1.7	12.5	ND	No odor
	11/18/97	6 - 8	Dark brown F-M SAND, some Silt, little F-M Gravel; Wet at 6 ft, becomes grey F-M SAND, trace Silt at 7.5 ft	<1.3	---	---	
SB-C4	11/19/97	0 - 2	Grey to brown to orange F-M SAND, trace Gravel; Dry to Moist	<1.1	---	---	
	11/19/97	2 - 4	Orange-brown to black F-M SAND; Moist	1.8	---	---	Ground water at 4.5 ft bls
SB-A4	11/19/97	0 - 2	Brown F-M SAND, little Gravel; Moist	<1.1	---	---	
	11/19/97	2 - 4	Brown to dark brown SAND; Moist	1.7	1.6	---	
	11/19/97	4 - 6	Dark brown to brown to grey to black SAND, little Gravel; Moist	1.4	3.2	---	Ground water at 6.5 ft bls
SB-E3	11/19/97	0 - 2	Dark brown SAND, little Gravel; Dry to Moist	<1.1	---	---	
	11/19/97	2 - 4	Brown to dark brown F-M SAND; Moist	2.1	1.2	---	
	11/19/97	4 - 6	Dark brown to black F-M SAND, little Gravel; Very Moist	3.1	47	---	
	11/19/97	6 - 8	Black to grey F-M SAND; Very Moist	<1.1	4.4	---	Ground water at 6.5 ft bls
SB-F2	11/19/97	0 - 2	Light orange brown F-M SAND, trace Silt; Moist	<1.1	---	---	No odor, geotextile liner at 2 ft bls
	11/19/97	2 - 4	Brown to dark brown F-M SAND, Some Silt, little F-M Gravel; Moist	1.7	1.4	2	No odor
	11/19/97	4 - 6	Dark brown to black F-M SAND; Moist	1.9	30	ND	No odor
SB-I4	11/19/97	0 - 2	Brown to dark brown F-M SAND; Moist	<1.1	---	---	No odor
	11/19/97	2 - 4	Dark brown to black F-M SAND; Very Moist	1.9	1.3	---	No odor
SB-M3	11/19/97	0 - 2	Brown to dark brown F-M SAND; Moist	<1.1	---	---	Slight odor (swamp)
	11/19/97	2 - 4	Dark brown to black F-M SAND, little F-M Gravel; Very Moist	7.5	60	---	Ground water at 3 ft bls

Table 1. Summary of Geoprobe™ Soil Boring and Sampling Data for the Benzene and Toluene Source Area Investigation, Intersection of Commerce Way and Atlantic Avenue, Industri-Plex Site, Woburn, Massachusetts

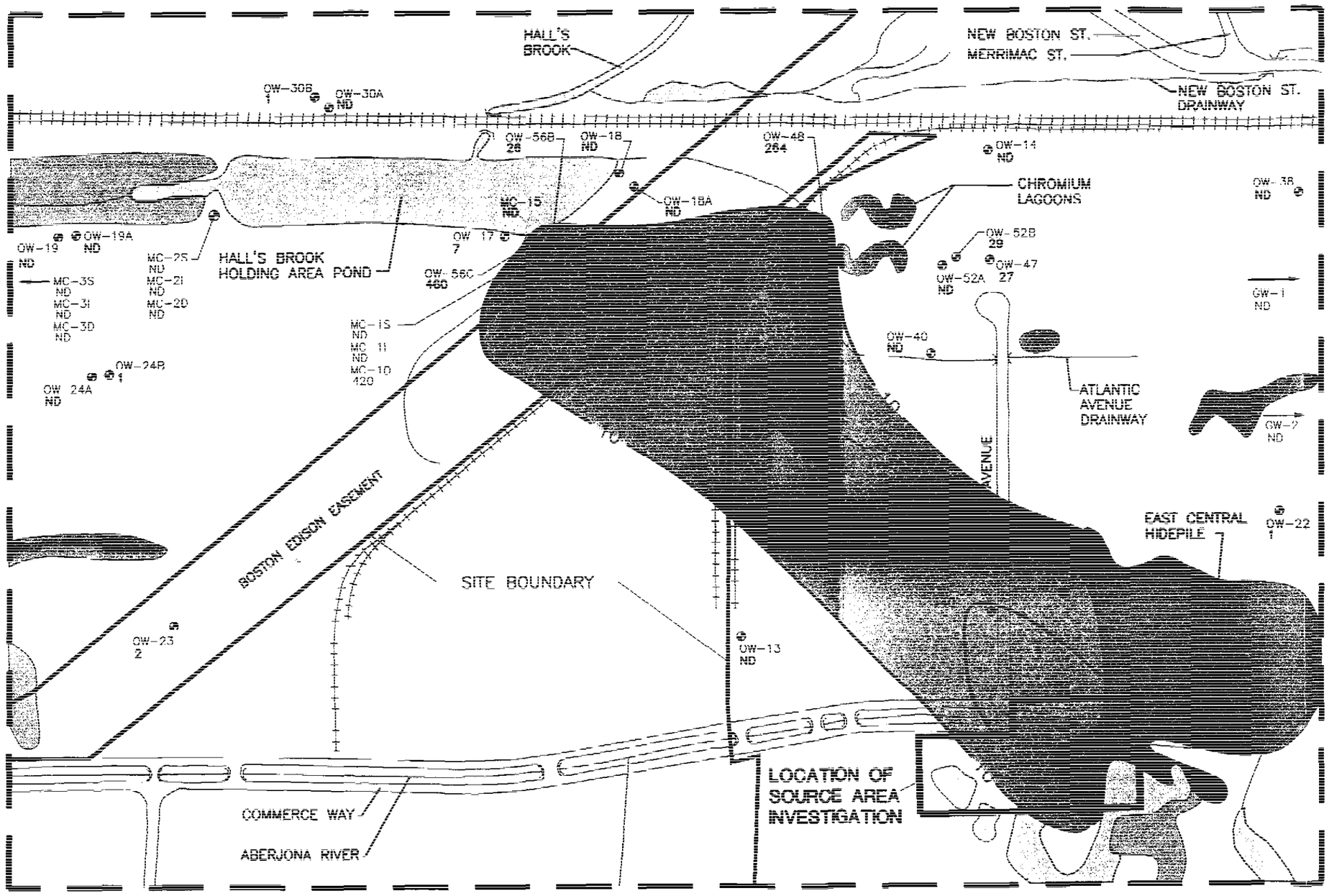
					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-M5	11/19/97	0 - 2	Dark brown F-M Sand, little F-M Gravel; Moist	<1.1	---	---	No odor
	11/19/97	2 - 4	Dark brown to black F-M SAND, little F-M Gravel; Very Moist	2.1	1.8	---	No odor, ground water at 2.5 ft bls
SB-FG2	11/19/97	0 - 2	Grey to Brown F-M SAND, little F-M Gravel	<1.1	---	---	
	11/19/97	2 - 4	Brown to orange-brown F-M SAND; Moist	2.2	1.3	---	
	11/19/97	4 - 6	Brown to orange-brown to grey F-M SAND, little F-M Gravel; Very Moist	2.4	5.8	---	No odor, ground water at 6.5 ft bls
SB-C6	11/20/97	0 - 2	Dark brown to black F-M SAND; little F-M Gravel; Very Moist	<1	---	---	
	11/20/97	2 - 4	Dark brown to black F-M SAND; Moist	1.8	3.6	---	No odor
	11/20/97	4 - 6	Black to brown SAND, little F-C Gravel; Very Moist	1.9	1.3	---	No odor, ground water at 6 to 6.5 ft bls
SB-E6	11/20/97	0 - 2	Brown F-M SAND, little F-M Gravel	<1	---	---	
	11/20/97	2 - 4	Dark brown to black F-M SAND, little Gravel, Slightly Moist	1.7	1.3	5	Geotextile barrier at 1 ft bls
	11/20/97	4 - 6	Brown to grey F-M SAND, F-C Gravel	1.7	1.25	---	No odor
SB-K4	11/20/97	0 - 2	Dark brown F-M SAND; little Gravel; Moist	<1	---	---	
	11/20/97	2 - 4	Dark brown F-M SAND, little F-M Gravel	2	1.9	---	Refusal at 3 ft, bls, ground water at 2.5 ft bls
SB-I6	11/20/97	0 - 2	Dark brown to brown F-M SAND, little Gravel	1.8	1	---	Refusal at 2.5 ft bls
SB-L6	11/20/97	0 - 2	Brown to dark brown F-M SAND, little F Gravel; Moist	<1	---	---	
SB-L6	11/20/97	2 - 4	Dark brown F-M SAND; Moist	2.1	5.8	---	
SB-L6	11/20/97	4 - 6	Dark brown to black to brown F-M SAND, little F-M Gravel; Moist	2	1.85	---	Ground water at 5 ft bls, refusal at 5.5 ft bls
SB-M2	11/20/97	0 - 2	Grey F-M SAND, little Gravel; Dry to Moist	<1	---	---	No odor
	11/20/97	2 - 4	Brown to grey to black F-M SAND; Moist	4.1	5.8	---	Odor
	11/20/97	4 - 6	Black to grey F-M SAND; Very Moist	6.2	12.5	ND	Odor

Table 1. Summary of Geoprobe™ Soil Boring and Sampling Data for the Benzene and Toluene Source Area Investigation, Intersection of Commerce Way and Atlantic Avenue, Industri-Plex Site, Woburn, Massachusetts

					BTEX		
Boring Designation	Sampling Date	Depth Interval (ft bls)	Lithologic Description	PID Reading (ppm)	Test Kit Results (ppm)	Laboratory Results (µg/kg)	Remarks
SB-D4	11/21/97	0 - 2	Dark brown F-M SAND, some Silt, little F-C Gravel, becomes light brown to orange brown F-M SAND at 0.5 ft; Moist	<1	---	---	Geotextile barrier at 2 ft bls
	11/21/97	2 - 4	Dark brown to black F-M SAND, some Silt, trace Gravel; Moist to Wet	1.8	5.6	---	Slight odor
	11/21/97	4 - 6	Dark brown to black F-M SAND, some Silt; Moist to Wet at 6 ft	1.7	0.6	---	Slight odor
	11/21/97	6 - 8	Dark brown to black grades to grey-brown F-M SAND, little Silt; Wet	<1	---	---	No odor
SB-E5	11/21/97	0 - 2	Dark brown grades to orange-brown F-M SAND, little Silt; Moist	<1	---	---	No odor, geotextile barrier at 2 ft bls
	11/21/97	2 - 4	Dark brown to black F-M SAND, some Silt; Dry to Moist	2.5	5.5	---	No odor, bedrock refusal at 5 ft bls, no ground water
SB-E6	11/21/97	0 - 2	Dark brown to brown-orange F-M SAND, little Gravel	<1	---	---	
	11/21/97	2 - 4	Dark brown F-M SAND; F-M Gravel	2.1	7	---	Bedrock refusal at 3.9 ft bls
SB-E7	11/21/97	0 - 2	Dark brown to brown to orange F-M SAND, little Gravel	<1	---	---	
SB-E7	11/21/97	2 - 4	Brown to grey to light grey SAND, little F-M Gravel	1.9	1.2	---	Refusal at 4.5 ft bls
SB-D6	11/21/97	0 - 2	Brown to orange F-M SAND	<1	---	---	
	11/21/97	2 - 4	Brown to dark brown F-M SAND	1.8	4	---	Bedrock refusal at 4 ft bls
SB-D7	11/21/97	0 - 2	Dark brown to orange F-M SAND, little F-M Gravel	<1	---	---	
	11/21/97	2 - 4	Dark brown to black to grey F-M SAND, little F-M Gravel; Moist	3.2	19	---	No odor, no ground water, refusal at 4.3 ft bls

ft bls - feet below land surface
F - fine
M - medium
C - coarse
PID - photoionization detector
ppm - parts per million
BTEX - benzene, toluene, ethylbenzene and xylenes (total)
µg/kg - micrograms per kilogram
< - less than
--- - sample not analyzed

FIGURES



Original includes color coding.

LEGEND

MC-3S ND — LOCATION AND DESIGNATION OF SSI MICRO WELL CLUSTER

CONCENTRATION OF TOLUENE IN GROUND WATER, MEASURED IN MICROGRAMS PER LITER (ug/L)

GW-4 — LOCATION AND DESIGNATION OF SSI GEOPROBE SAMPLING POINT

OW-12 1,000 — LOCATION AND DESIGNATION OF FORMER MONITORING WELL

MAXIMUM CONCENTRATION OF TOLUENE DETECTED IN GROUND WATER IN 1990 AND 1991, MEASURED IN ug/L

ND — NOT DETECTED

10 — LINE OF EQUAL TOLUENE CONCENTRATION, IN ug/L

POTENTIAL SOURCE AREAS

WETLANDS

SURFACE WATER BODIES

EXTENT OF GROUND WATER CONTAINING TOLUENE AT CONCENTRATIONS EXCEEDING 10 ug/l IN 1991-92

NOTES:
1. DATA SHOWN ARE MAXIMUM TOLUENE CONCENTRATIONS DETECTED DURING SAMPLING EVENTS CONDUCTED DURING THE PDI AND GSIP RI, BETWEEN MARCH 1990 AND DECEMBER 1991.
2. EXTENT OF TOLUENE PLUME ADAPTED FROM PLATE 6 OF GSIP PHASE 2 RI REPORT (ROUX ASSOCIATES, INC. 1992)

300' 0 300'

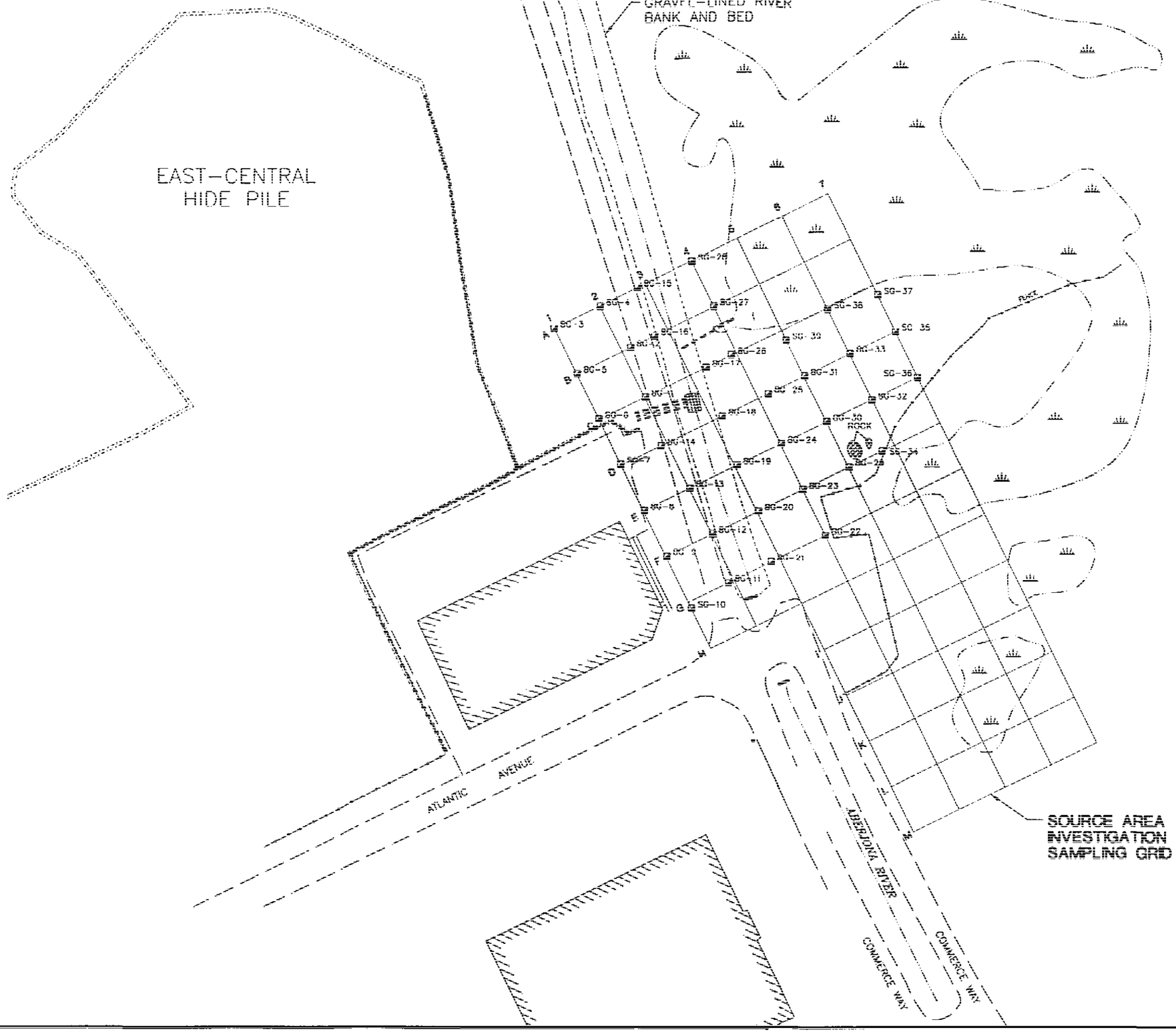
Title:
LOCATION OF SOURCE AREA INVESTIGATION AND HISTORICAL EXTENT OF TOLUENE IN GROUND WATER

BENZENE AND TOLUENE SOURCE AREA INVESTIGATION

Prepared For
INDUSTRI-PLEX SITE REMEDIAL TRUST

ROUX ASSOCIATES INC.
Environmental Consulting & Management

Compiled by: DB	Date: 07JAN98	FIGURE
Prepared by: BHC	Scale: AS SHOWN	1
Project Mgr.: L.M.	Status: FINAL	
File No: M2610610	Project: 06626M15	



LEGEND

SG-3 LOCATION AND DESIGNATION OF SOIL GAS SURVEY SAMPLE

BASEMAP SOURCE:
LAYOUT WORKSHEET ROUX WELL 50' GRID, PREPARED BY MERIDIAN SERVICES, INC., NOVEMBER 25, 1997.

100' 0 100'

Title:

SOIL GAS SURVEY SAMPLING LOCATIONS

BENZENE AND TOLUENE SOURCE AREA INVESTIGATION

Prepared For:
INDUSTRI-PLEX SITE REMEDIAL TRUST

ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: DB	Date: 06JAN98	FIGURE
Prepared by: BHC	Scale: As Shown	2
Project Mgr: I M	Status: Draft	
File No: M2612303	Project: 06626M15	

EAST–CENTRAL
HIDE PILE

GRAVEL–LINED RIVER
BANK AND BED

SB–A4
8 ft: ND

SB–A2
10 ft: ND

SB–C6
8 ft: ND

SB–C4
8 ft: ND

SB–D6
4 ft: Refusal, Dry

SB–E7
4.5 ft: Refusal, Dry

10 ft: ND
SB–C2

SB–D4
8 ft: ND

SB–E6
4 ft: Refusal, Dry

SB–E5
5 ft: Refusal, Dry

ROCK

SB–E6
Refusal, Dry

SB–E7
4 ft: Refusal, Dry

SB–E4
8 ft: ND

SB–E3
8 ft: ND
25 ft: ND

SB EF4
14 ft: ND

SB–E2
8 ft: ND
25 ft: 6,400

SB–F1
8 ft: ND
20 ft: ND

SB–F3
24 ft: 13,000

SB–G4
8 ft: ND

SB–FG2
8 ft: ND

SB–G3
13 ft: 20,000
16.6 ft: Refusal

SB–H2
8 ft: ND

SB–H2
18 ft: ND
20 ft: 2,400

SB–I6
2.5 ft: ND

SB–I4
5 ft: ND

SB–I2
14 ft: 50

SB–K4
3 ft: ND

SB–L6
5 ft: ND

SB–M5
6 ft: ND

SB–M3
5 ft: ND

FENCE

ATLANTIC AVENUE

COMMERCE WAY

COMMERCE WAY

ABERJONA RIVER

N

SOURCE AREA INVESTIGATION SAMPLING GRID

LEGEND

SB–A2 — LOCATION AND DESIGNATION OF SOIL BORING

14 ft: 50 — DEPTH OF GROUND–WATER SAMPLE, IN FEET

CONCENTRATION OF TOLUENE IN GROUND WATER, IN MICROGRAMS PER LITER

ND — TOLUENE NOT DETECTED

NOTE:

BENZENE WAS NOT DETECTED IN ANY OF THE GROUND–WATER SAMPLES.

BASEMAP SOURCE:

LAYOUT WORKSHEET ROUX WELL 50' GRID, PREPARED BY MERIDIAN SERVICES, INC., NOVEMBER 25, 1997.

60' 0 60'

Title:

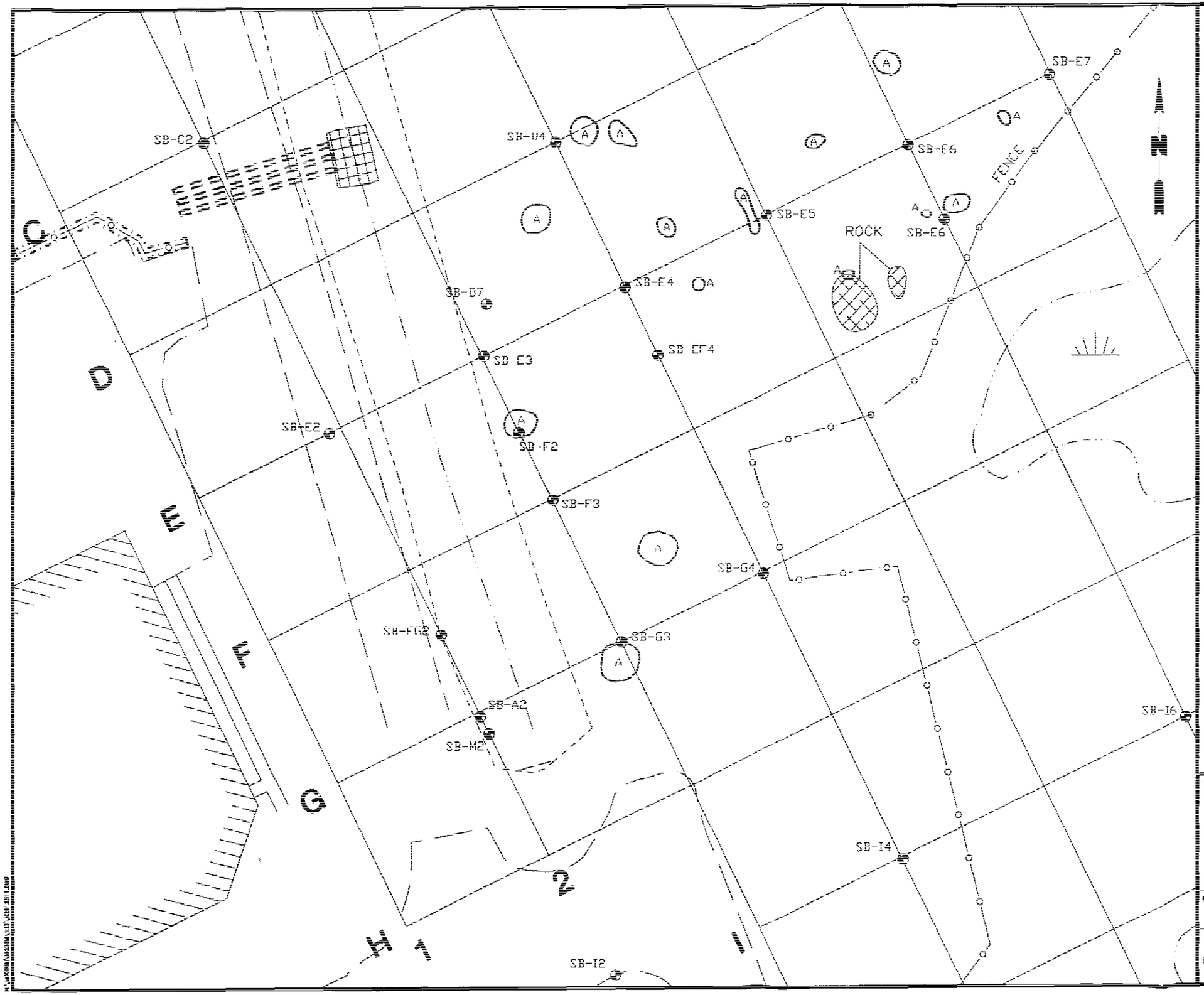
SOIL BORING LOCATIONS AND GROUND–WATER SAMPLING RESULTS

BENZENE AND TOLUENE SOURCE AREA INVESTIGATION

Prepared For:
INDUSTRI–PLEX SITE REMEDIAL TRUST

ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: DB	Date: 06JAN98	FIGURE
Prepared by: BHC	Scale: As Shown	3
Project Mgr: LM	Status: Draft	
File No: M2612.304	Project: 06626M15	



LEGEND

SB-A2 LOCATION AND DESIGNATION OF SOIL BORING

(A) ANOMOLY IDENTIFIED DURING GPR SURVEY AND TEST PIT LOCATION

(A) ANOMOLY IDENTIFIED DURING MAGNETOMETER SURVEY

Original includes color coding.

BASEMAP SOURCE:
LAYOUT WORKSHEET ROUX WELL 50' GRID, PREPARED BY MERIDIAN SERVICES, INC., NOVEMBER 25, 1997.

30' 0 30'

Title:

LOCATIONS OF TEST PITS AND GEOPHYSICAL SURVEY ANOMALIES

BENZENE AND TOLUENE SOURCE AREA INVESTIGATION

Prepared For:
INDUSTRI-PLEX SITE REMEDIAL TRUST

ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: DB	Date: 05JAN98	FIGURE
Prepared by: BHC	Scale: As Shown	4
Project Mgr: LM	Status: Draft	
File No: M2612311	Project: 06026M15	

APPENDICES

APPENDIX A

Soil Gas Survey Report Prepared by
Pine & Swallow Associates, Inc.

Limited Subsurface Investigation

I.S.R.T Site
Commerce Way and Atlantic Avenue
Woubum, Mass

Prepared for

Roux Associates, Inc.
13 Branch Street
Methuen, MA 01844

Prepared by

PINE & SWALLOW ASSOCIATES, INC.
Environmental Scientists, Engineers and Designers

867 Boston Road
Groton, MA 01450
978-448-9511

December 3, 1997
PSA Reference Number: 97141

Pine & Swallow Associates, Inc.

Environmental Science, Engineering and Design

867 Boston Road, Groton, MA 01450
(508) 448-9511 Fax (508) 448-6645

Principals: Robert N. Pine, P.E.
John C. Swallow, Ph.D.

December 3, 1997

Larry McTiernan
Roux Associates, Inc.
13 Branch Street
Methuen, MA 01844

RE: ISRT, Woburn, Mass

Dear Larry,

In accordance with your request, Pine & Swallow Associates (PSA) has prepared this summary report of subsurface investigations performed at ISRT. This report summarizes the equipment and procedures employed by PSA for soil gas sampling, as well as the results of on-site gas chromatograph analyses of soil gas and water.

We appreciated the opportunity to work with you and thank you for engaging our services for this project. If there are any questions, please do not hesitate to call.

Sincerely yours,
Pine & Swallow Associates, Inc.

Gregory S. Rotondi
Environmental Chemist

Jeffrey A. Curtis
Senior Project Manager

Enclosure

Limited Subsurface Investigation
I.S.R.T Site
Commerce Way and Atlantic Avenue
Woburn, Mass

I. INTRODUCTION AND PROGRAM SUMMARY

On November 10, 11 and 18, 1997, Pine & Swallow Associates, Inc. (PSA) conducted limited subsurface investigations of the ISRT site. The purpose of PSA's effort was to assist Roux Associates, Inc. in assessing soil gas and ground water conditions at the site. Details of equipment and procedures for MicroWell® installation, soil gas sampling and the methodology and results of on-site gas chromatographic (GC) analyses of soil gas and ground water samples for selected volatile organic compounds are enclosed.

Program Summary

PSA's study included soil gas sampling at thirty-eight locations. At one location a soil gas sample was not attainable so a water sample was taken and analyzed. Soil gas samples were collected from two to four feet below ground surface (BGS) and were analyzed with an HP5890 GC for benzene and toluene in PSA's mobile laboratory. Six groundwater samples collected by Roux Associates field personnel were also analyzed by PSA.

All installation and sampling locations were chosen by Roux Associates, Inc. field personnel. All analyses were performed in PSA's field laboratory for compounds determined by Roux Associates, Inc.'s program.

® MicroWell and VibraDrill are registered trademarks of ProTerra, Inc., an affiliate of PSA.

II. FIELD INVESTIGATION METHODS AND PROCEDURES

SOIL GAS INVESTIGATION

Soil Gas Equipment and Methods

Soil gas analysis refers to gas chromatographic (GC) analysis of the soil atmosphere (soil gas) to detect volatiles originating from contaminated soil, from a contaminant ground water plume or from pure product floating on the ground water surface. Soil gas analysis allows comparison of concentrations of volatile constituents over an array of test locations to indicate pertinent dimensions of a discharge or plume.

Soil gas samples were obtained by driving a half-inch, steam-cleaned, hollow steel probe fitted with a drive point to a selected depth below grade with one of PSA's VibraDrills. The probe was then pulled back and a rod was used to drive the point beyond the end of the probe thereby creating a sampling cavity.

Samples were collected by sealing the top of the sampling probe with a tubing adapter which connects to a monitoring panel and vacuum pump. Ten volumes of air were purged from the sampling system by use of a battery powered pump. During purging, flow and pressure measurements were recorded.

To collect a soil gas sample for GC analysis, the sampling tubing was isolated from the vacuum pump by a selector valve. After purging of the MicroWell, a gas sample was withdrawn through a silicon rubber section of the sampling tubing with a 10 mL syringe. The syringe needle was capped with a septum and the sample delivered immediately to the mobile laboratory. Thirty-eight samples were logged in by the chemist with a chain of custody form which includes the syringe ID, sampling location and sample depth, and analyzed according to PSA's analytical SOP.

GROUND WATER INVESTIGATION

Six Groundwater samples were collected by Roux Associates, Inc. field personnel and one groundwater sample was collected by PSA for field analysis. PSA provided preserved vials for collection and on site analysis in PSA's mobile laboratory.

FIELD CHEMISTRY

PSA utilizes Hewlett Packard 5890 gas chromatographs to analyze soil, water and soil gas matrices for a variety of organic environmental contaminants. Gas chromatography (GC) technology physically separates the components of a contaminated matrix and the contaminants are then identified using compound-specific detectors. PSA's GC instrumentation currently employs three different detection modes. The electron capture detector (ECD) is primarily used to identify electromagnetic molecules such as chlorinated, brominated and fluorinated compounds. The photoionization detector (PID) is effective in the determination of aromatic and/or aliphatic contaminants such as benzene, toluene, ethylbenzene and xylenes (BTEX). Analysis is conducted in accordance with PSA's Standard Operating Procedures (SOPs).

For water and soil headspace sample matrices which are analyzed to determine BTEX/MTBE and chlorinated contaminants, field samples undergo preparation steps prior to analysis. For water samples (collected in 40 mL VOA vials), an aliquot of the water sample is removed from the closed sampling vial to create headspace within the vial. Samples are warmed to ambient temperature, agitated briefly and the headspace within the vial is allowed to reach equilibrium for a short period. An aliquot of the headspace is withdrawn by gas-tight syringe and injected into the on-site gas chromatograph for analysis. PID/ECD detector modes are utilized for compound identification.

An appropriate analytical capillary column is selected for the suite of analytes under study. Once the sample is prepared for analysis and introduced into the GCs heated inlet injection port, it is transported in its gaseous form to the analytical column. As a sample migrates through this column, its various components interact with the column film to become temporarily adsorbed and subsequently desorbed. Each compound in the test sample transits the column at a different rate which is temperature controlled and enhanced, hence creating a unique retention time. Each compound also elicits a unique response from the detectors. These responses are translated within the data collection system in the form of peaks which are assigned height and area values relative to analyses of analytical standards. This data is subsequently evaluated to determine concentration of the target analyte within the sample matrix.

Identification and quantification of target analytes detected in the sample are achieved by retention time comparisons to reference standards formulated with analytical grade compounds of known concentrations. For all analyses, blank samples from syringes, sampling equipment and reagents are analyzed periodically to ensure sample and method integrity. Daily check standards are run to verify instrument stability, calibration, sensitivity and performance. Duplicate analyses and replicate sample injections are routinely conducted to support method accuracy and analytical precision.

III. ANALYTICAL RESULTS

SOIL GAS ANALYSES

Thirty-eight locations chosen by Roux Associates, Inc. field personnel were sampled for soil gas at depths ranging from two to four feet BGS using PSA's VibraDrill K100. Thirty-eight soil gas samples were analyzed for bezene and toluene on a Hewlett Packard 5890 GC in PSA's field laboratory.

Results of soil gas analyses for the compounds selected by Roux Associates, Inc. field representatives and performed at ISRT are included in the Appendix. Results of soil gas analyses showed benzene and toluene were not present in amounts greater than the practical quantification limit.

Negative soil gas findings at a test location do not guarantee that the soil or ground water at depth is free of contaminants because geologic and or hydrologic conditions may be present that prevent upward diffusion of volatiles from deeper horizons. For example, a part of a contaminant plume that is overlain by clean water typically cannot be detected in the soil atmosphere. Experience with soil gas reconnaissance also shows that the distance a contaminant plume can be traced from a source depends on geologic, hydrologic and man-made features that are unique to each site. Additionally, positive findings at a sampling location can arise from soil contamination only and do not confirm that the underlying ground water has been impacted.

GROUND WATER ANALYSES

Seven ground water samples were analyzed for benzene and toluene by a Hewlett Packard 5890 GC in PSA's field laboratory. Results of the ground water analyses are tabulated in Table 1.

TABLE 1
On Site Volatile Organic Analysis
ISRT, Site Address
Ground Water
11-18-97
[ppb]

Sample ID	Sample Depth	Benzene	Toluene	NOTES
C-2	0-8	<PQL	1.0	
GWA-2	0-8	<PQL	<PQL	
GWE2	0-8	<PQL	<PQL	
GWC2	0-8	<PQL	<PQL	
G-4	0-8	<PQL	<PQL	
GW-4	0-8	<PQL	<PQL	
SG22	0-4.0	<PQL	<PQL	water sample from soil gas point
Reporting Limits		<1.0	<1.0	

<PQL indicates analyte below method reporting limit
NA=not analyzed

Ground water samples were analyzed for benzene and toluene as determined by Roux Associates, Inc.'s program. Results showed benzene and toluene were not present in amounts greater than the practical quantification limit.

This report is submitted subject to the limitations stated in the Appendix.

APPENDIX

Analytical Results

Limitations and Conditions

LIMITATIONS AND CONDITIONS

1. The observations described in this report were made under the conditions stated. The conclusions presented in the report were based solely upon the services described and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by Client. The report has been prepared in accordance with generally accepted hydrogeological and hydrochemical practices. No other warranty, express or implied, is made.

2. Negative findings for the presence of volatile organic compounds using soil atmosphere analysis are not positive or absolute proof that disposal or discharge of chemicals has not occurred in the past at the sampled locations or anywhere else on the site. Negative findings are not positive or absolute proof that migration, seepage or any other movement of chemicals is not occurring at the sampled locations or elsewhere on the site.

3. Chemical conditions reported herein reflect conditions at the locations tested within the limitations of the methods used. Such conditions can vary rapidly from area to area. No warranty is expressed or implied that chemical conditions other than those reported do not exist within the site.

4. At those locations where volatile organic compounds were reported, chemicals other than those reported may be present. Chemical analyses have been performed for specific parameters during this assessment. However, additional chemical constituents not searched for during the current study may be present in soil and/or ground water at the site.

5. This report has been prepared for Roux Associates, Inc. solely for use in an environmental evaluation of property at ISRT, Woburn Mass.

Analytical Results

TABLE 1
On Site Volatile Organic Analysis
ISRT, Site Address
Soil Gas Analysis 11-10-97 /11-11-97
[ppbv]

Sample ID	Sample Depth	Benzene	Toluene	
SG1	3.5-4.0	<PQL	<PQL	
SG2	3.5-4.0	<PQL	<PQL	
SG3	3.5-4.0	<PQL	<PQL	
SG4	3.5-4.0	<PQL	<PQL	
SG5	3.5-4.0	<PQL	<PQL	
SG6	3.5-4.0	<PQL	<PQL	
SG7	3.5-4.0	<PQL	<PQL	
SG8	3.5-4.0	<PQL	<PQL	
SG9	3.5-4.0	<PQL	<PQL	
SG10	3.5--4.0	<PQL	<PQL	
SG11	3.5 4.0	<PQL	<PQL	
SG12	3.5-4.0	<PQL	<PQL	
SG13	3.5-4.0	<PQL	<PQL	
SG14	3.5-4.0	<PQL	<PQL	
SG15	3.5-4.0	<PQL	<PQL	
SG16	3.5-4.0	<PQL	<PQL	
SG17	3.5-4.0	<PQL	<PQL	
SG18	3.5-4.0	<PQL	<PQL	
SG19	3.5-4.0	<PQL	<PQL	
SG20	2.5-4.0	<PQL	<PQL	
SG21	3.5-4.0	<PQL	<PQL	
SG23	3.5-4.0	<PQL	<PQL	
SG24	2.5-4.0	<PQL	<PQL	
SG25	3.5-4.0	<PQL	<PQL	
SG26	3.0-3.5	<PQL	<PQL	
SG27	3.0-3.5	<PQL	<PQL	
SG28	3.5-4.0	<PQL	<PQL	
SG29	3.0-3.5	<PQL	<PQL	
SG30	3.5-4.0	<PQL	<PQL	
SG31	3.5-4.0	<PQL	<PQL	
SG32	3.5-4.0	<PQL	<PQL	
SG33	3.5-4.0	<PQL	<PQL	
SG34	3.5-4.0	<PQL	<PQL	
SG35	3.5-4.0	<PQL	<PQL	
SG36	3.5-4.0	<PQL	<PQL	
SG37	3.0-3.5	<PQL	<PQL	
SG38	2.0-2.5	<PQL	<PQL	
SG39	3.5-4.0	<PQL	<PQL	
Reporting Limits		<1.0	<1.0	

<PQL indicates analyte below method reporting limit
NA=not analyzed

APPENDIX B

Geophysical Survey Report Prepared by
Geophysics GPR International, Inc.

GEOPHYSICAL INVESTIGATION

INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Presented to:

ROUX ASSOCIATES, INC.
13 Branch Street
Methuen, Massachusetts 01844

Presented by:

GEOPHYSICS GPR INTERNATIONAL, INC.
13 Highland Circle, Suite E
Needham Heights, Massachusetts 02194

January 7, 1998

GPR No. B97181
Roux No. 06626M15

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2.2 Ground Penetrating Radar (GPR) Method 2
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Figure 5. Ponds and West of River Area: Total Magnetic Field Strength Map
Figure 6. Ponds and West of River area: Vertical Magnetic Gradient Strength Map
Figure 7. Radar Surveys Area: Location Map

1.0 INTRODUCTION

Magnetic and ground penetrating radar surveys were conducted for Roux Associates, Inc. at the Industri-Plex site in Woburn, Massachusetts. The geophysical surveys, covering several acres, were conducted on different days during the period of November 12 to 26, 1997. The objective of these surveys was to locate buried drums and/or small underground storage tanks (USTs) possibly located within the survey area.

The site locus is at the intersection of Atlantic Avenue and Commerce Way about one mile northwesterly of the intersection of Routes 95/128 and 93. The areas of investigation are part of a large former industrial facility. The general site area is bounded by Commerce Way, Route 93, and private properties (see Figure No. 1).

There is one large area of interest that was surveyed by magnetometry with portions of this area surveyed with ground penetrating radar. Overall, the investigated area is generally rectangular-shaped, open ground containing areas of dense brush, exposed bedrock, and wet areas, approximately 300 feet in an northeast-southwest direction and 600 feet in a northwest-southeast direction. The geophysical survey area was subdivided into two smaller areas, the Peninsula and the Ponds and West of River areas, due to the presence of a small river crossing the site and small ponds.

2.0 METHODS OF INVESTIGATION

2.1 Magnetic (Gradiometric) Method

The magnetic method employs a proton precession magnetometer to measure the total magnetic field (TMF) strength. The TMF is the actual field strength, which consists of any buried ferrous source superimposed on that of the earth. Local variations in the earth's magnetic field strength depend on the presence of ferromagnetic material, such as iron and magnetite.

Changes in the magnetic field strength near such materials are attributed to induced and remanent magnetization. A ferromagnetic material acquires an induced magnetization when placed in an external magnetic field. Remanent magnetization is permanent magnetization, which may be acquired during the manufacturing of steel products.

A gradiometer was used during this investigation. A gradiometer is simply a magnetometer with two magnetic field sensors, one mounted at a fixed height above the other. Two measurements are then taken at each station. The difference in the magnetic strength between the upper and lower sensors is the vertical magnetic gradient (VMG).

The VMG provides several advantages over the TMF strength, including 1) improved lateral resolution of anomalies; 2) increased sensitivity to shallow magnetic sources; and

3) since readings are taken almost simultaneously, the measured gradient is independent of temporal magnetic fluctuations. Since the earth's magnetic field constantly changes over the course of a day, a dedicated base station is usually positioned near the site or at a point that is frequently returned to (looping method) to take repetitive readings in order to correct for this diurnal variation. A base station was used due to the moderate size of the investigated area.

2.2 Ground Penetrating Radar (GPR) Method

Ground penetrating radar (GPR) employs high resolution radar to detect buried objects and subsurface stratigraphy. Many of the principles of GPR are similar to that of the seismic reflection method used in oil and gas exploration. The transmitting antenna emits brief pulses of electromagnetic energy into the ground. During the time between pulses, the receiving antenna records energy which has been reflected back to the surface.

Radar waves are reflected by interfaces between media with differing dielectric constants, such as geologic contacts, buried objects, or voids. The dielectric constant is controlled by factors such as water content, density, and composition. The depth of penetration is limited by the operating frequency of the transmitter and the electrical conductivity of the ground.

The GPR unit records the two-way travel time and the amplitude of the reflected signals. The typical radar anomaly produced by a cylindrical object, such as an intact drum, pipe, or tank, traversed at right angles, is a convex-upward hyperbolic reflection. The source of the anomaly is located at the apex of the hyperbola.

3.0 DATA ACQUISITION

3.1 Equipment

The magnetic survey was accomplished using a Scintrex Envi-Mag gradiometer. Each reading of the total magnetic field and vertical magnetic gradient strength was automatically stored in the memory portion of the unit along with the coordinates of the station, time, date, drift between stations, and statistical error. The data were transferred to a computer for further processing, including diurnal variations.

A GSSI SIR-3 ground penetrating radar system with 100 and 500 mHz antennas was used at this site. All field data were printed on an electrostatic recorder.

3.2 Survey Design and Procedures

A general grid was established by the field crew within which the gradiometric and radar surveys were conducted. Grid nodes were marked every fifty feet with non-magnetic construction pin flags and paint spots and station positions were marked every ten feet with paint spots across the areas in orthogonal directions.

The geophysical grid is coincident with and is superimposed on a 50 foot grid system established by Meridian Land Services, Inc. This grid system was intended for the use of Roux Associates personnel in the performance of a soil gas investigation. The geophysical grid laid out by Geophysics GPR utilizes distances and directions, that is feet north-south and east-west of a reference point.

Our geophysical grid reference point, designated 0N/0E, is located ten feet south of soil gas grid point E-3 (SG-19) on soil gas line 3. Therefore, the soil gas coordinate D-3 is coincident with our geophysical grid point 60N/0E, and soil gas coordinate F-3 is coincident with our geophysical grid point 40S/0E. This relationship is maintained throughout the survey.

Departures from the grid occurred at intervals within the surveyed areas, due primarily to the presence of dense brush, exposed bedrock, and wet areas. The gradiometric data acquisition was along parallel lines spaced every five feet with measurement stations located every five feet along each line. The radar data acquisition was along parallel lines spaced three feet apart with continuous measurements along each line.

The radar survey was performed mostly with the 500-mHz antenna to permit high resolution surveying. Lower frequency (80 and 100 mHz) antennas permit greater depths of exploration while reducing spatial resolution, so was infrequently used.

4.0 RESULTS

4.1 Magnetic (Gradiometric) Surveys

The processed gradiometric data are presented as 11"x 17" color contour maps (Figures 2, 3, 5, and 6). The color plots allow rapid visual assimilation of the geophysical information. The contour maps show the variation of two parameters across the site: (1) total magnetic field (TMF) strength and (2) vertical magnetic gradient (VMG) strength.

Interpretation of the gradiometric data involved identifying the geophysical responses from surface features noted by the geophysicist. A few geophysical responses at this facility are clearly due to known objects, such as buried utilities, surface drain grates, discarded ferrous objects, and fences. Most responses could not be explained by observed objects or features.

The total magnetic values are plotted in nanoteslas (N:) and the vertical magnetic

gradient in Nt per meter (Nt/m), standard units of magnetic flux density. Referring to the color contour map of the magnetic data, the highest value is shown in red in both figures, indicating the areas of the highest concentration of ferrous objects. The blank areas represent places where data were not collected, for example, adjacent to fences.

The magnetic Interpretation map 4A displays the major features observed at the site. These identified anomalies are not attributable to any observed surface features such as fences, buried utilities, and discarded materials. A cross within an anomaly indicates the point of highest intensity and may serve as a target point.

Because this site contains known different ferrous features, it is possible to identify a magnetic anomaly as indicative of these features, particularly if they are defined as linear anomalies. The Interpretation map for the Peninsula area displaying the results of the magnetic surveys (see Figure No. 4A) shows several known features found affecting the magnetic data.

No Interpretation map for the Ponds and West of River area was generated since the magnetic anomalies could be accounted for by numerous observed surface ferrous objects such as car parts, construction debris, and discarded household items. Additionally, the bedrock appears to contain ferromagnetic minerals, with a number of anomalies directly associated with bedrock exposures.

The magnetic anomalies are outlined on Interpretation map 4A. These marked anomalies, most of them, include small, narrowly-defined features typically associated with small, shallowly buried ferrous objects, that is, the same as the observed discarded household items. The objects identified with an "A" represent those anomalies that appear to be significant. The outline of the magnetic anomalies was determined as the minimum extent of the anomalous response from the total field data.

Note that the size of the anomalous zones reflect the area of influence of the geophysical data. The anomalies represented will be larger than the actual objects producing the responses. Experience has shown that an anomaly should be defined as an anomalous response in both parameters.

The magnetic maps show a strong response in both measured parameters indicative of buried ferrous objects occurring mostly within the northern portion of the site. The magnetic data display areas of concentrations of ferrous objects. The magnetic data also exhibit linear anomalies, which are due to discreet features such as buried utilities, concrete barriers, and fences.

4.2 Ground Penetrating Radar

Ground penetrating radar (GPR) records obtained in the field are time sections. In order

to convert the two-way travel times to depth, the velocity of radar waves in the subsurface must be determined. Velocities can be calculated by surveying objects of known depth or using an averaging method based upon the nature of the site materials.

The objective of performing a GPR survey was to try to detect buried drums or USTs, hence the close line spacing of three feet. The radar penetration within the overall site was excellent with depths of penetration ranging from six to eight feet. Calibration of the radar signal was obtained over an iron storm drain pipe within the site.

Numerous subsurface objects were detected including stratigraphic interfaces, probable discarded debris, utilities, drainlines, and disturbed soils. Since GPR covered a substantial portion of investigated site, the results of both the gradiometric and radar surveys are described in the two following areas.

4.3 Peninsula Area

Includes the area referred to at the site as the "peninsula," which is a lobe of fill materials extending easterly into a wetland in the vicinity of the river channel and is included within our grid coordinates 60S/110N to 0E/180E.

Examination of the contour map of total field strength (see Figure No. 2) shows a large-scale positive amplitude magnetic anomaly, indicating a concentration of ferrous materials throughout the central portion of the area. Some effect of steel reinforced concrete barriers and chainlink fences are included in this concentration. However, no other ferrous source objects were observed on the surface.

Inspection of the vertical gradient map (see Figure No. 3) of the same area shows the large-scale magnetic anomaly resolved into numerous smaller anomalies. Any of these smaller anomalies could include one or more steel drums as ferrous source objects.

Comparison and correlation of radar and magnetic data from this area have resulted in an Interpretation map of this area (see Figure No. 4B). The 4B interpretation map shows locations of magnetic anomalies which correspond to recorded radar anomalies. In addition, Figure 4B shows several radar anomalies that do not correspond with magnetic anomalies shown on Figure 4A. For four of these radar anomalies, the character of the radar signal suggests the possibility of an object with a drum-like radar signal. These particular anomalies have been designated with the letter "A" on map 4B.

4.4 Ponds and West of River Area

The magnetic maps corresponding to this area (see Figure Nos. 5 and 6) show the strength of the total magnetic field and the vertical magnetic gradient in the northwesterly

and southeasterly sections of the area of investigation. The magnetic maps are similar in character to the magnetic maps of Peninsula area, above.

The large-scale magnetic anomalies indicate the presence of a considerable mass of ferromagnetic material over a wide area. The vertical gradient map resolves the large-scale anomaly into numerous smaller anomalies. The northwesterly and southeasterly sections are separated by a river (drainage course) and are discussed separately below.

Coverage of the southeasterly section, the Ponds area, is somewhat fragmented by the presence of ponds and marshes. Surface observations of this area revealed numerous steel objects at or near the surface including auto parts, appliances, steel cables, etc. Bedrock outcrops are present in the vicinity of the ponds.

It appears likely that many or all of the small ferrous anomalies in this section may be due to this sort of ferrous debris located at or near the surface. However, the possibility of one or more steel drums cannot be discounted. A small section at the northerly edge of this area was included in the radar survey which covered the Peninsula Area. The results and correlation are included on the interpretation map of the Peninsula area.

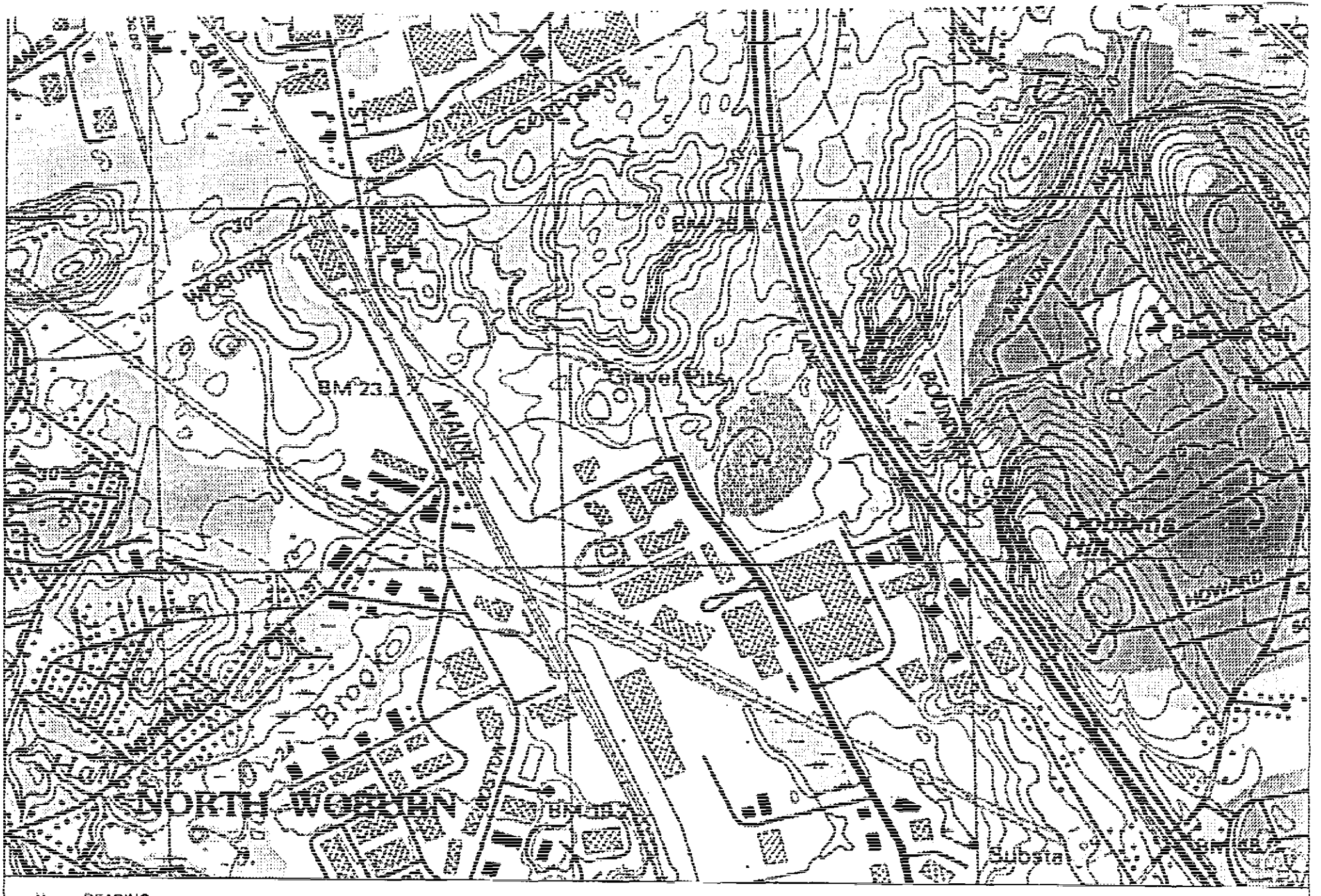
Many of the anomalies in the northwesterly section, the West of River area, are likely due to the presence of ferromagnetic objects at the surface, including chainlink fences and gates, steel reinforced cement blocks, and nearby vehicles. A magnetic anomaly centered near our grid position 95N/45W was given particular attention with the radar surveys; the results suggest a group of iron reinforced drain pipes as the source object.

5.0 CONCLUSIONS

The results of the gradiometric and ground penetrating radar surveys conducted at this facility indicate responses from known surface ferrous objects, buried ferrous objects, buried debris, disturbed ground, and shallow bedrock. Both the total field and vertical magnetic gradient contour maps aided in the generation of interpretation maps of buried ferrous objects.

Ground penetrating radar data of very good quality were collected across the surveyed area. The overall depth of penetration with GPR at this site averaged six to eight feet. The GPR survey located subsurface features indicative manmade objects, responses associated with small cylindrical objects (designated as "A" anomalies), areas of disturbed ground, and interfaces indicative of placed fill.

The subsurface complexity of the surveyed area, due to the burial of many discarded objects and shallow bedrock, control the identified magnetic and radar anomalies.



Name: READING
Date: 1/7/98
Scale: 1 inch equals 1000 feet

Location: 042° 31' 06.5" N 071° 08' 22.6" W
Caption: INDUSTRI-PLEX SITE
WOBURN, MA
B97181 FIGURE NO. 1

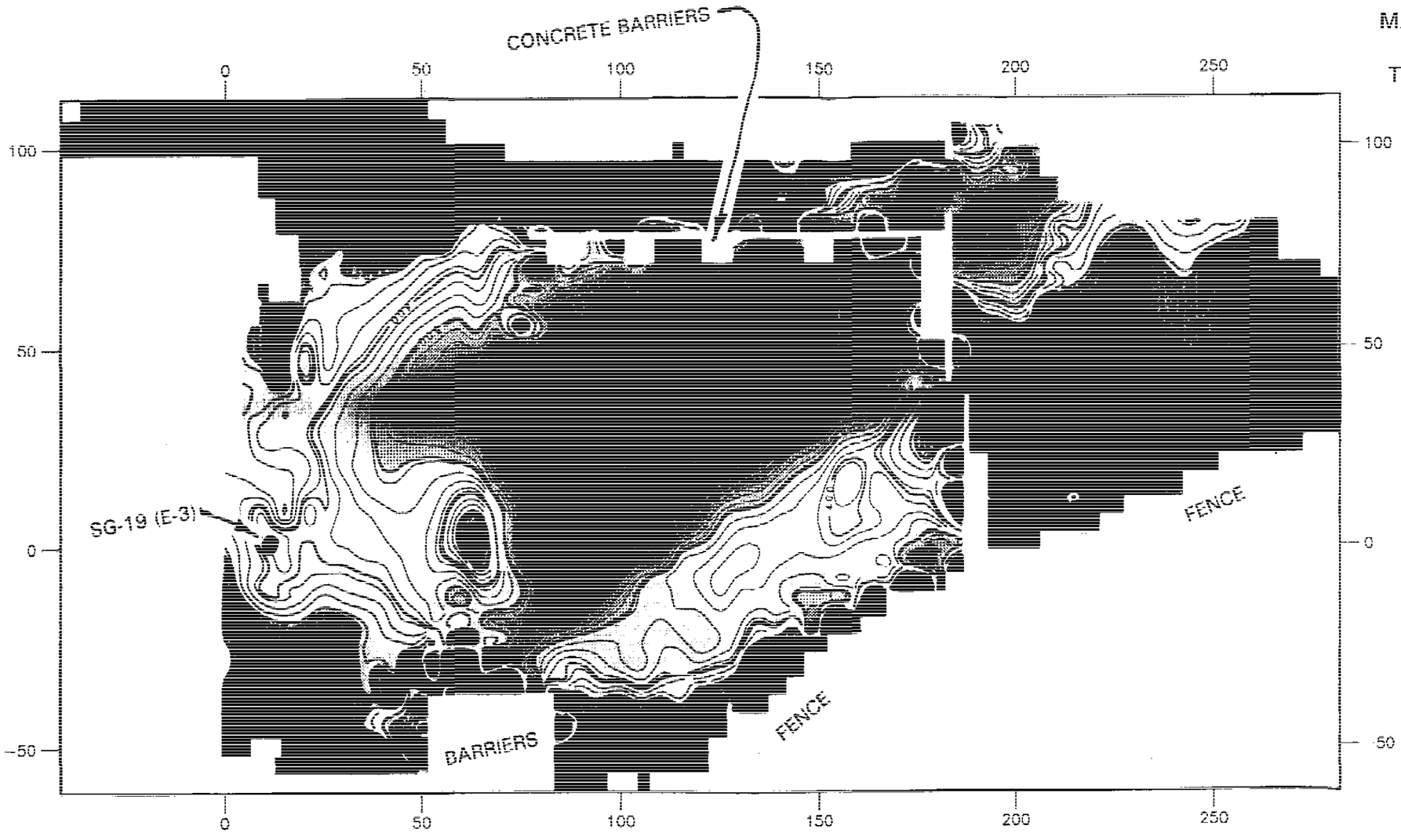
ROUX ASSOCIATES

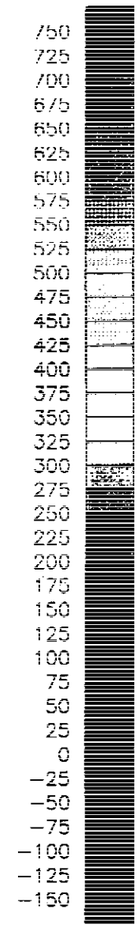
INDUSTRI-PLEX SITE
WOBURN, MA

PENINSULA AREA
MAGNETOMETER SURVEY

TOTAL MAGNETIC FIELD

Figure No. 2





Original includes color coding.

Scale 1"=30'

25 0 25

(feet)

GEOPHYSICS GPR INTERNATIONAL INC B97161 Jean-Marc Crespy, P. Eng.

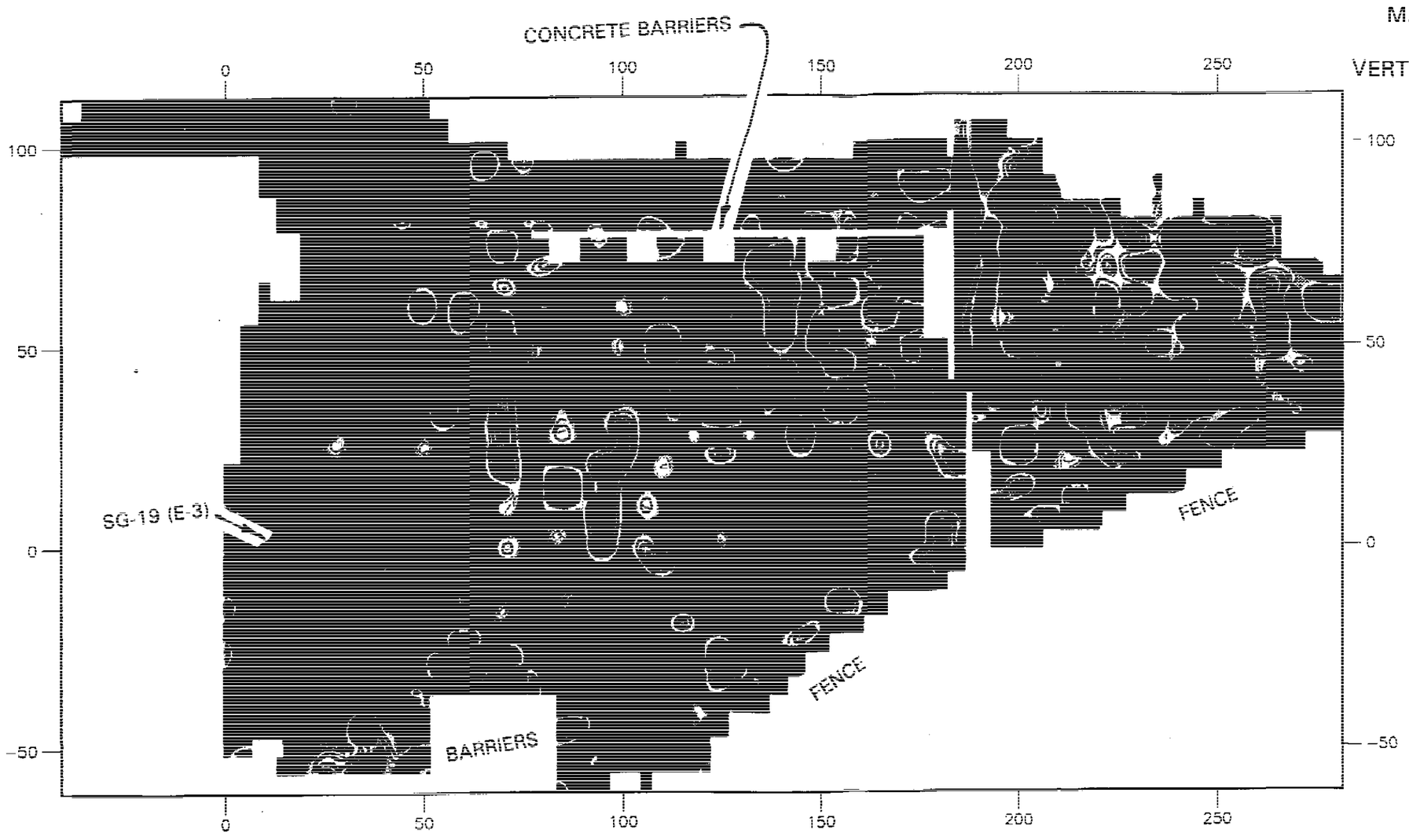
ROUX ASSOCIATES

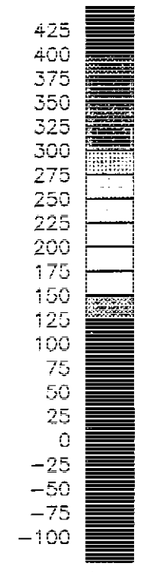
INDUSTRI-PLEX SITE
WOBURN, MA

PENINSULA AREA
MAGNETOMETER SURVEY

VERTICAL MAGNETIC GRADIENT

Figure No. 3





Original includes color coding.

Scale 1"=30'

25 0 25

(feet)

GEOPHYSICS GPR INTERNATIONAL INC 897181 Jean-Marc Crespy, P. Eng.

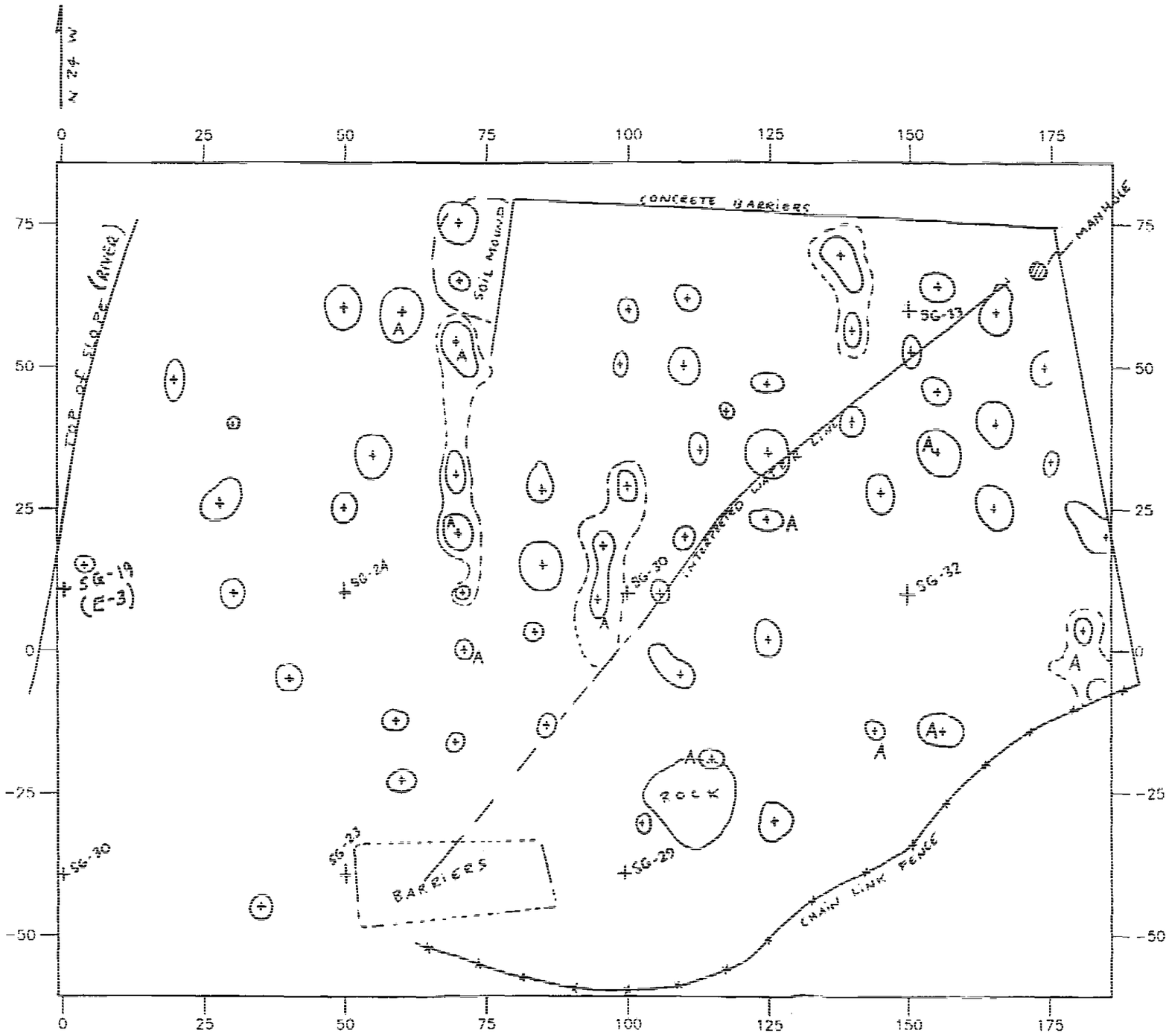
ROUX ASSOCIATES

INDUSTRI-PLEX SITE
WOBURN, MA

PENINSULA AREA
MAGNETOMETER SURVEYS

INTERPRETATION MAP

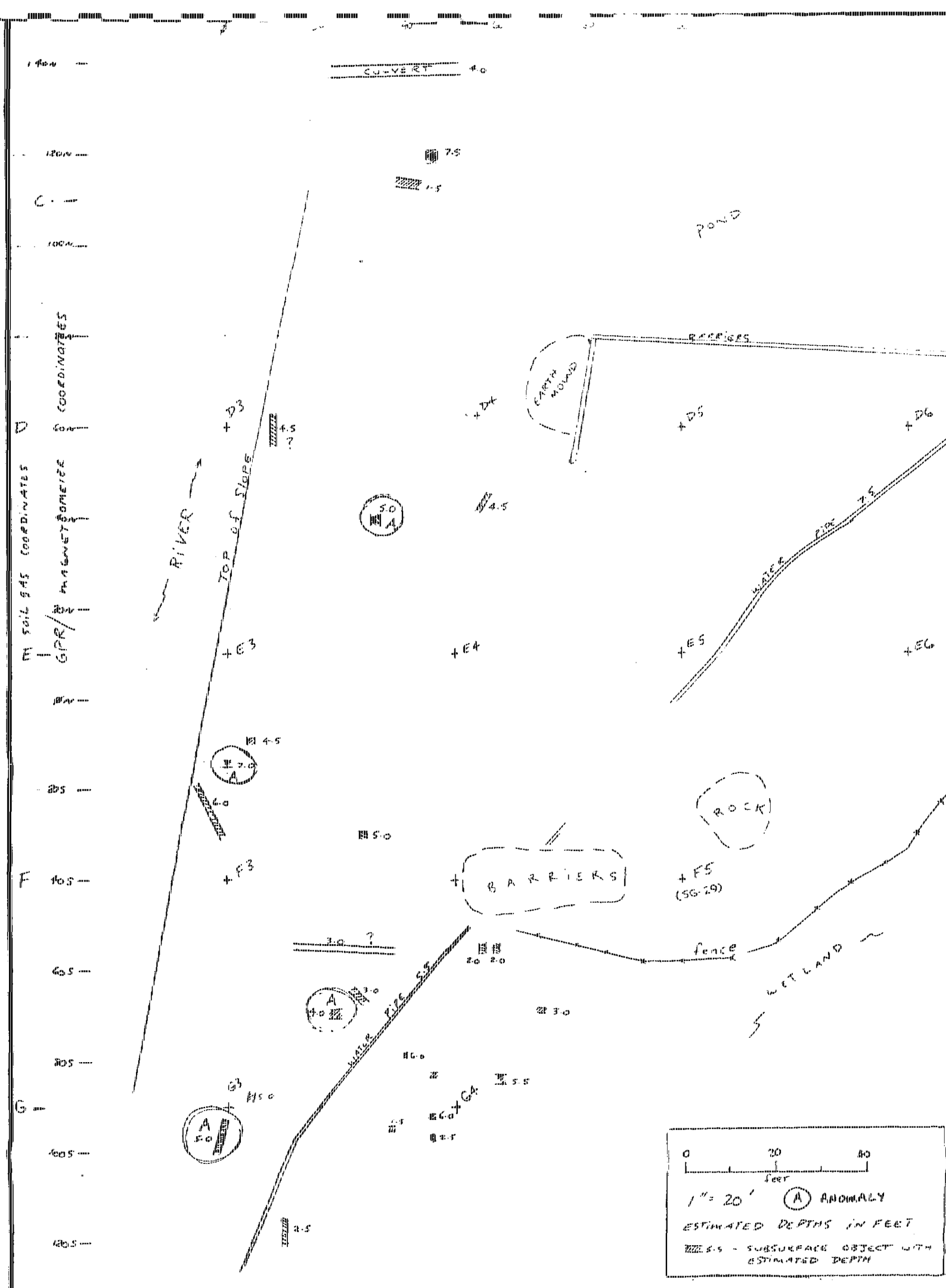
Figure No. 4A



SCALE 1" = 20'

10 0 10 20
(feet)

GEOPHYSICS GPR INTERNATIONAL INC 897181 Jean-Marc Crespy, P. Eng.

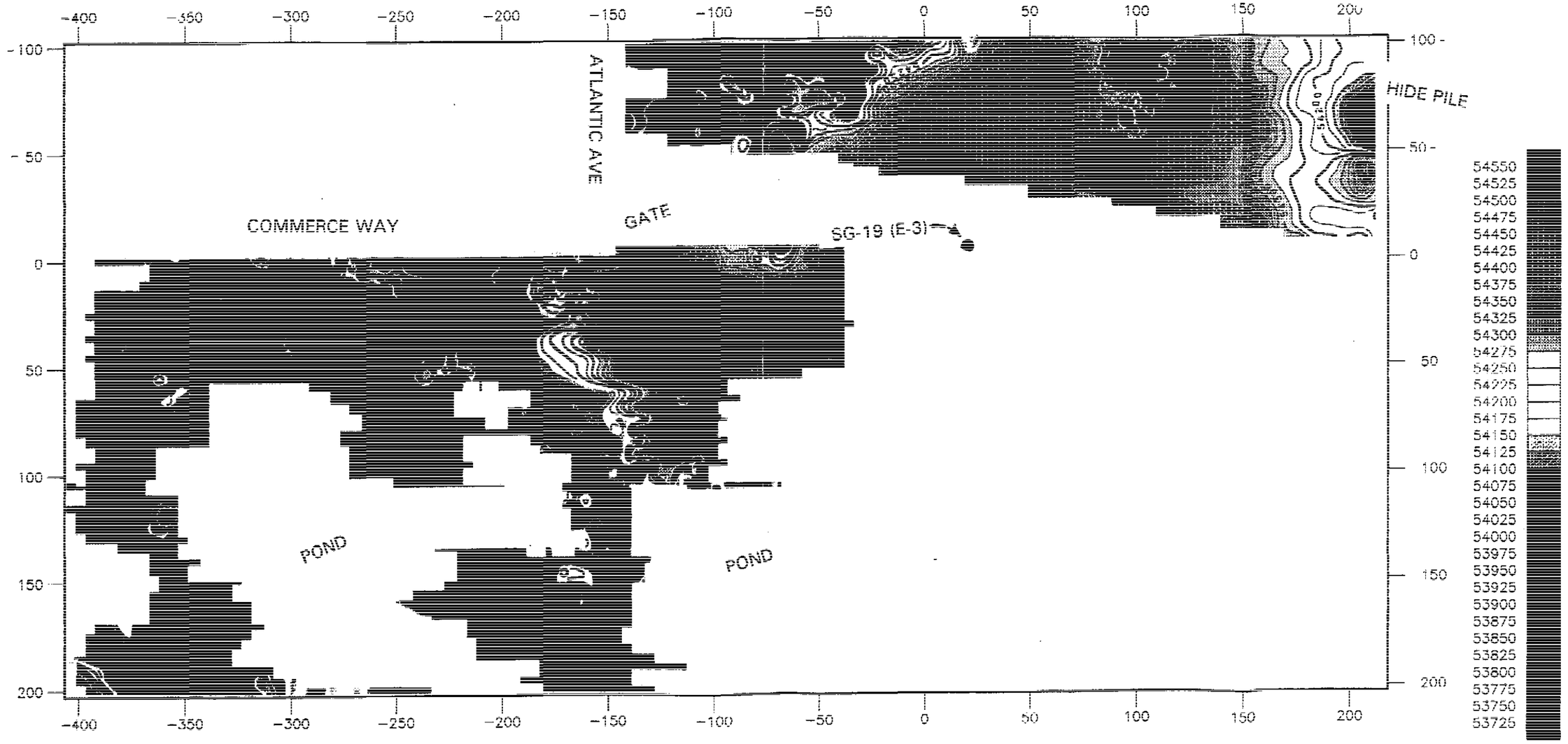


GEOPHYSICS GPR INTERNATIONAL, INC		
PROJ. # 897181	TITLE RADAR ANOMALY MAP PENINSULA AREA	
DRAWN BY M. Kick	CLIENT ROUX ASSOCIATES, INC.	
CHECKED BY M. Kick	PROJECT INDUSTRI-PLEX SITE WOBURN, MA	
APPROVED BY L. Tyrala	DRAWING DATE 11/21/97	SCALE 1" = 20'
Figure No. 48		

ROUX ASSOCIATES

INDUSTRI-PLEX SITE
WOBURN, MA
PONDS AND WEST OF RIVER AREA
MAGNETOMETER SURVEY
TOTAL MAGNETIC FIELD

Figure No. 5



Original includes color coding.

Scale 1" = 50'

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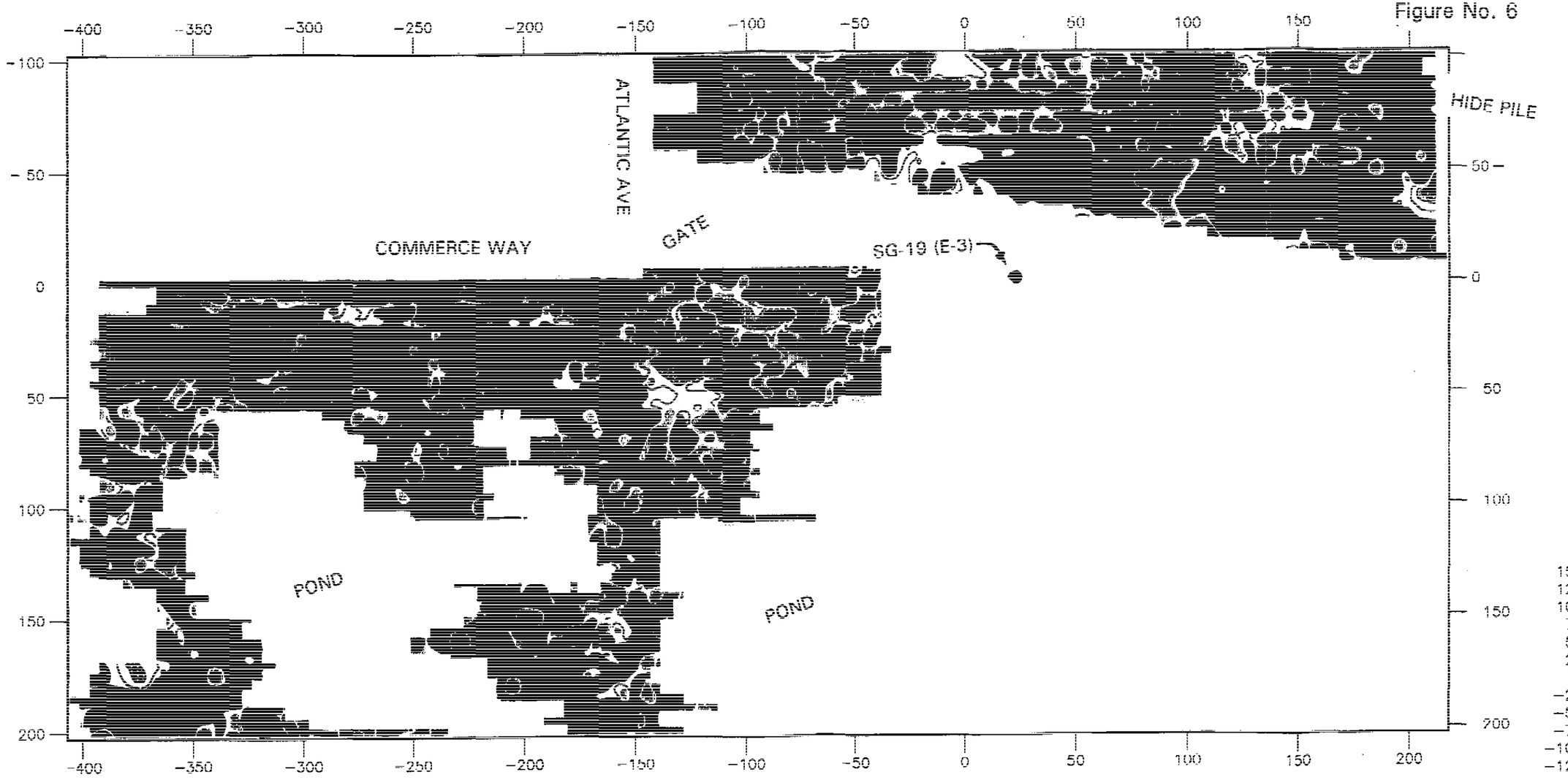
(feet)

GEOPHYSICS GPR INTERNATIONAL INC 897181 Jean-Marc Crespy, P. Eng.

ROUX ASSOCIATES

INDUSTRI-PLEX SITE
WOBURN, MA
PONDS AND WEST OF RIVER AREA
MAGNETOMETER SURVEY
VERTICAL MAGNETIC GRADIENT

Figure No. 6



Original includes color coding.

Scale 1" = 50'

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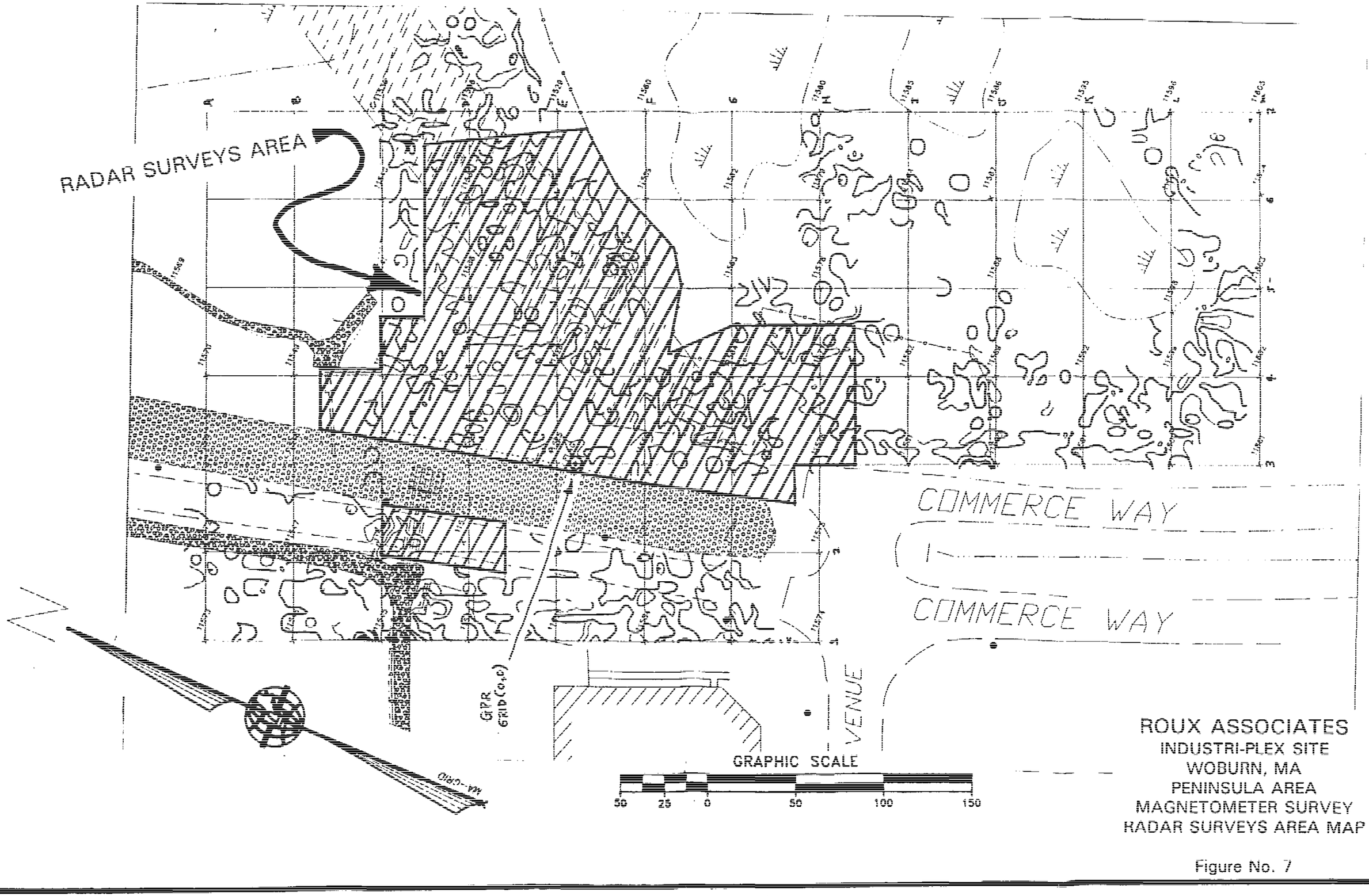
(feet)

GEOPHYSICS GPR INTERNATIONAL INC 897181 Jean-Marc Crespy, P. Eng.



ROUX ASSOCIATES
INDUSTRI-PLEX SITE
WOBURN, MA
PENINSULA AREA
MAGNETOMETER SURVEY
RADAR SURVEYS AREA MAP

Figure No. 7

APPENDIX C

BTEX-in-Soil Test Kit Calculation Forms

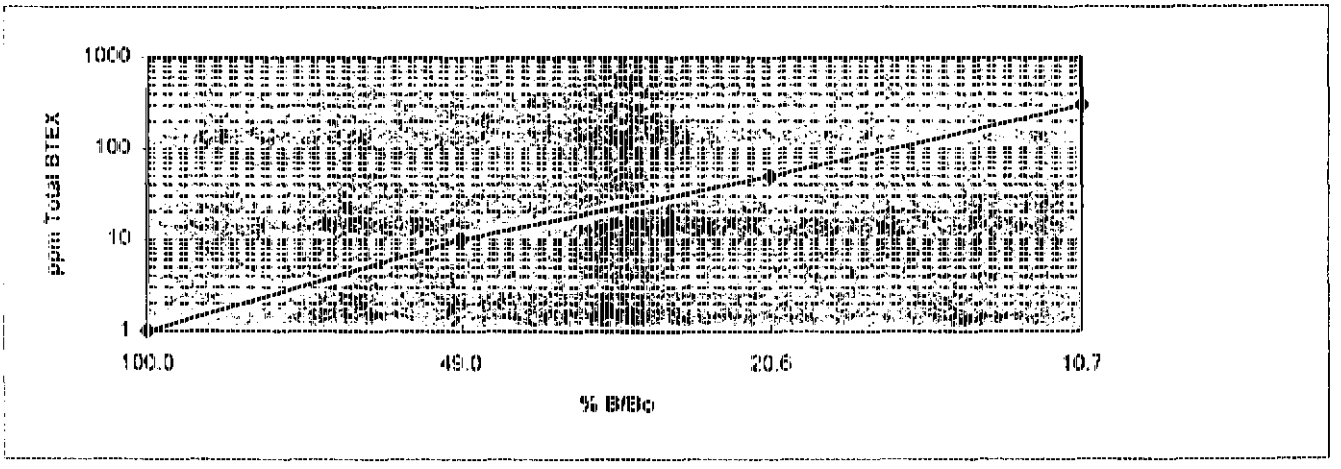
Date:	11/18/97	Project #:	06626M15
Time:	17:00	Project Name:	Industri-Plex Site
Operator:	A. Farrell	Project Location:	Woburn, MA
Assay Calibrator:	Total BTEX in Soil		
Photometer:	Millipore Differential Photometer		

Results

Sample ID	OD (450nm)			AVG. OD (450nm) % Bo	PPM (BTEX)
Neg Calibrator	0.85	0.84	0.84	100.0	1
10 ppm Calibrator	0.41	0.42	0.41	49.0	10
50 ppm Calibrator	0.18	0.17	0.17	20.6	50
300 ppm Calibrator	0.09	0.09	0.09	10.7	300
SB A2 / 2-4'	0.87	0.86	0.86	102.4	0
SB A2 / 4-6'	0.59	0.60	0.60	70.6	3.7
SB A2 / 6-8'	0.28	0.26	0.26	31.5	26
SB C2 / 2-4'	0.85	0.85	0.85	100.8	0
SB C2 / 4-6'	0.78	0.80	0.79	93.7	1.3
SB C2 / 6-8'	0.87	0.86	0.87	102.8	0
SB C2 / 6-8' DUP	0.80	0.80	0.80	94.9	1.25
SB E2 / 2-4'	0.82	0.82	0.82	97.3	1.15
SB E2 / 4-6'	0.69	0.70	0.68	81.9	2.3
SB E4 / 2-4'	0.68	0.68	0.68	80.7	2.4
SB E4 / 4-6'	0.37	0.38	0.38	44.7	12.5
SB G2 / 2-4'	0.82	0.83	0.83	79.9	2.5
SB G2 / 4-6'	0.66	0.67	0.69	98.1	1.1
SB G4 / 2-4'	0.79	0.80	0.80	94.5	1.45

AVG. OD (450nm) % Bo = OD (450nm) Sample X/OD (450nm) 0 ppm Standard

*-Negative calibrator = 0ppm, however it must be plotted as a value of 1 on the semilog graph.



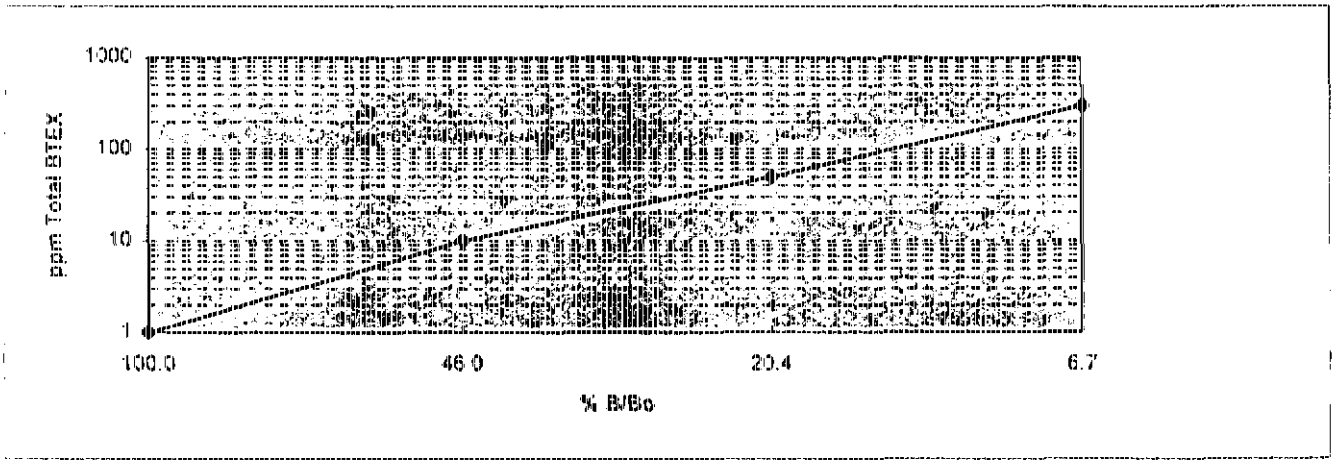
Date:	11/19/97	Project #:	06626M15
Time:	17:00	Project Name:	Industri-Plex Site
Operator:	A. Farrell	Project Location:	Woburn, MA
Assay Calibrator:	Total BTEX in Soil		
Photometer:	Millipore Differential Photometer		

Results

Sample ID	OD (450nm)			AVG. OD (450nm) % Bo	PPM (BTEX)
Neg Calibrator	0.95	0.95	0.95	100.0	1
10 ppm Calibrator	0.45	0.42	0.44	46.0	10
50 ppm Calibrator	0.20	0.19	0.19	20.4	50
300 ppm Calibrator	0.06	0.07	0.06	6.7	300
SB A4 / 2-4'	0.85	0.84	0.85	89.1	1.6
SB A4 / 4-6'	0.69	0.69	0.69	72.6	3.2
SB E3 / 2-4'	0.90	0.93	0.91	96.1	1.2
SB E3 / 4-6'	0.20	0.20	0.20	21.1	47
SB E3 / 6-8'	0.61	0.62	0.63	65.3	4.4
SB F2 / 2-4'	0.87	0.88	0.87	91.9	1.4
SB F2 / 4-6'	0.28	0.27	0.27	28.8	30
SB FG2 / 2-4'	0.89	0.89	0.90	94.0	1.3
SB FG2 / 2-4' DUP	0.86	0.87	0.87	91.2	1.5
SB FG2 / 4-6'	0.55	0.57	0.56	58.9	5.8
SB I4 / 2-4"	0.89	0.89	0.89	93.7	1.3
SB M3 / 2--4'	0.19	0.17	0.19	19.3	60
SB M5 / 2-4'	0.83	0.83	0.82	87.0	1.8

AVG. OD (450nm) % Bo = OD (450nm) Sample X/OD (450nm) 0 ppm Standard

*-Negative calibrator = 0ppm, however it must be plotted as a value of 1 on the semilog graph.



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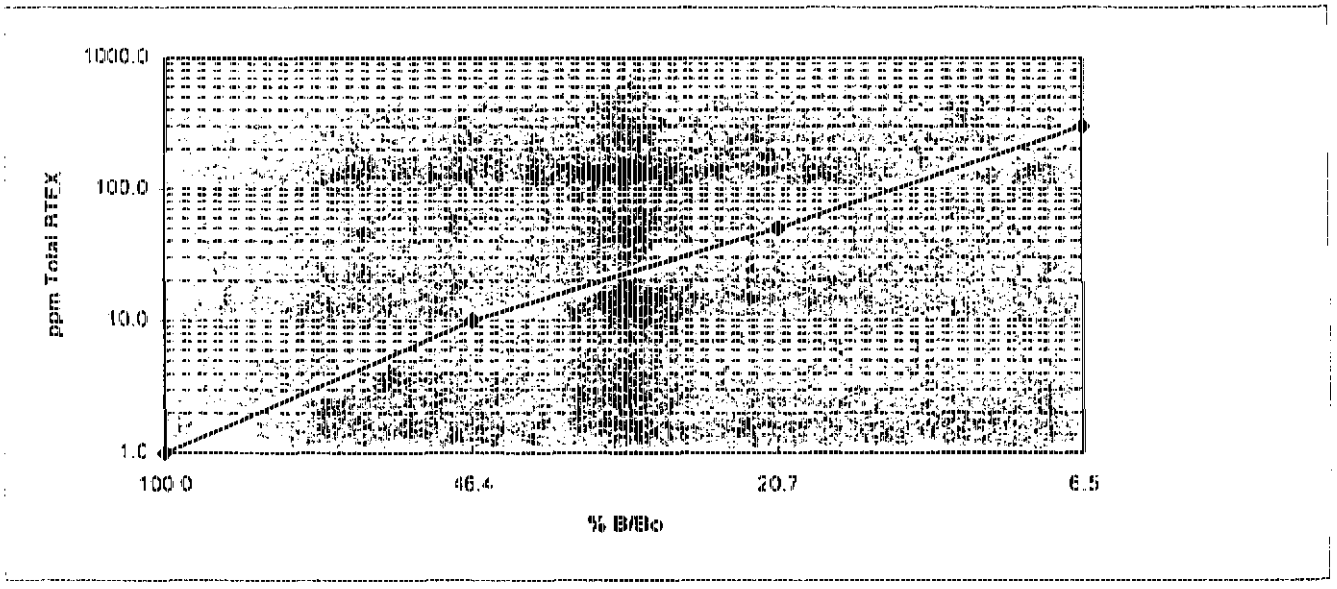
Time:	17:00	Project Name:	Industri-Plex Site
Operator:	A. Farrell	Project Location:	Woburn, MA
Assay Calibrator:	Total BTEX in Soil		
Photometer:	Millipore Differential Photometer		

Results

Sample ID	OD (450nm)			AVG. OD (450nm) % Bo	PPM (BTEX)
Neg Calibrator	0.87	0.87	0.87	100.0	1.0
10 ppm Calibrator	0.41	0.4	0.4	46.4	10
50 ppm Calibrator	0.18	0.18	0.18	20.7	50
300 ppm Calibrator	0.05	0.06	0.06	6.5	300
SB C6/ 2-4'	0.61	0.61	0.61	70.1	3.6
SB C6/ 4-6'	0.82	0.82	0.81	93.9	1.3
SB E6/ 2-4'	0.83	0.81	0.82	94.3	1.3
SB E6 / 4-6'	0.81	0.83	0.84	95.0	1.25
SB I6 / 0-2'	0.86	0.88	0.86	99.6	1
SB K4 / 2-4'	0.75	0.74	0.73	85.1	1.9
SB L6 / 2-4'	0.50	0.51	0.52	58.6	5.8
SB L6 / 4-6'	0.75	0.76	0.74	86.2	1.85
SB L6 / 4-6' DUP	0.75	0.77	0.75	87.0	1.8
SB M2/ 2-4'	0.52	0.51	0.51	59.0	5.8
SB M2/ 4-6'	0.36	0.39	0.37	42.9	12.5

AVG. OD (450nm) % Bo = OD (450nm) Sample X/OD (450nm) 0 ppm Standard

*-Negative calibrator = 0ppm, however it must be plotted as a value of 1 on the semilog graph.



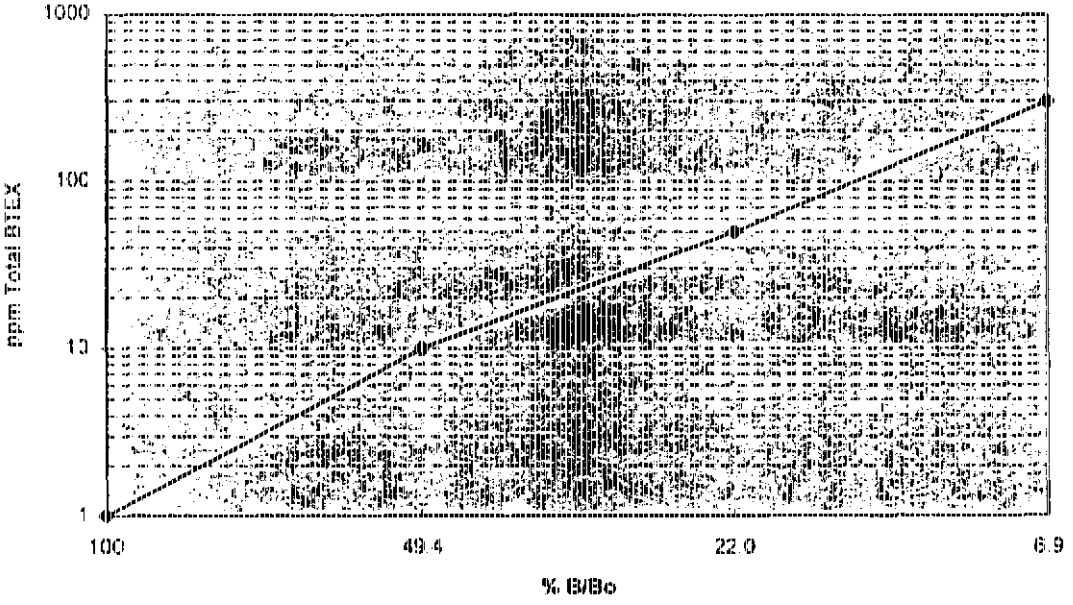
Date:	11/21/97	Project #:	06626M15
Time:	17:00	Project Name:	Industri-Plex Site
Operator:	A. Farrell	Project Location:	Woburn, MA
Assay Calibrator:	Total BTEX in Soil		
Photometer:	Millipore Differential Photometer		

Results

Sample ID	OD (450nm)			AVG. OD (450nm) % Bo	PPM (BTEX)
Neg Calibrator	0.82	0.82	0.81	100	1
10 ppm Calibrator	0.41	0.4	0.4	49.4	10
50 ppm Calibrator	0.18	0.18	0.18	22.0	50
300 ppm Calibrator	0.05	0.06	0.06	6.9	300
SB D4/ 2-4'	0.51	0.49	0.51	61.6	5.6
SB D4/ 4-6'	0.77	0.78	0.77	94.7	0.6
SB D6/ 2-4'	0.56	0.56	0.55	68.2	4
SB D7 / 2-4'	0.32	0.33	0.32	39.6	19
SB E5 / 2-4'	0.51	0.52	0.52	63.3	5.5
SB E6 / 2-4'	0.47	0.47	0.47	57.6	7
SB E7 / 2-4'	0.80	0.80	0.80	98.0	1.2
SB E7 / 2-4' DUP	0.71	0.70	0.69	85.7	2

AVG. OD (450nm) % Bo = OD (450nm) Sample X/OD (450nm) 0 ppm Standard

*-Negative calibrator = 0ppm, however it must be plotted as a value of 1 on the semilog graph.



APPENDIX D

Analytical Laboratory Report Prepared by
American Environmental Network

American Environmental Network
149 Rangeway Road • N. Billerica, MA 01862 • (978) 667-1400 • Fax (978) 667-7871

Mr. Larry McTiernan
Roux Associates
13 Branch Street, Suite 13
Methuen, MA 01844

December 1, 1997

Dear Mr. McTiernan:

Please find enclosed the analytical results of the sample(s) received at our laboratory on November 18, 1997. This report contains sections addressing the following information at a minimum:

- sample ID correspondence table
- analytical results
- chain-of-custody (if applicable)
- definitions of data qualifiers and terminology

Client Project #	056626M15	Client Project Name	N/A
IEA Report #	R119-075	Purchase Order #	N/A

Copies of this analytical report and supporting data are maintained in our files for a minimum of 3 years unless special arrangements are made. Unless specifically indicated, all analytical testing was performed at the IEA-Massachusetts laboratory.

We appreciate your selection of our services and welcome any questions or suggestions you may have relative to this report. Please contact your customer service representative at (978) 667-1400 for any additional information. Thank you for utilizing our services and we hope you will consider us for your future analytical needs.

I have reviewed and approved the enclosed data for final release

Sincerely,

Michael F. Wheeler, Ph.D.
Laboratory Director

IEA/American Environmental Network (MA)
MA-DEP #MA038

MW/dlb

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12/1/97, 11:33 am

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:	Roux Associates	AEN ID:	R119-075-01
Project:	06626M15	Sample:	SS-E4/4-6
Report Date:	11/21/97	Type:	Soil
Collected:	11/18/97	Container:	Glass
Received:	11/18/97		
Analyzed:	11/20/97	Dilution Factor:	1.4
By:	WJG		

Number	Compound	PQL ug/kg (dry)	Result ug/kg (dry)
1	Benzene	7	BQL
2	Bromodichloromethane	7	BQL
3	Bromoform	7	BQL
4	Bromomethane	14	BQL
5	Carbon tetrachloride	7	BQL
6	Chlorobenzene	7	BQL
7	Chloroethane	14	BQL
8	2-Chloroethylvinyl ether	7	BQL
9	Chloroform	7	BQL
10	Chloromethane	14	BQL
11	Dibromochloromethane	7	BQL
12	1,2-Dichlorobenzene	7	BQL
13	1,3-Dichlorobenzene	7	BQL
14	1,4-Dichlorobenzene	7	BQL
15	1,1-Dichloroethane	7	BQL
16	1,2-Dichloroethane	7	BQL
17	1,1-Dichloroethene	7	BQL
18	cis-1,2-Dichloroethene	7	BQL
19	trans-1,2-Dichloroethene	7	BQL
20	1,2-Dichloropropane	7	BQL
21	cis-1,3-Dichloropropene	7	BQL
22	trans-1,3-Dichloropropene	7	BQL
23	Ethylbenzene	7	BQL
24	Methylene chloride	7	BQL
25	1,1,2,2-Tetrachloroethane	7	BQL
26	Tetrachloroethene	7	BQL
27	Toluene	7	BQL
28	1,1,1-Trichloroethane	7	BQL
29	1,1,2-Trichloroethane	7	BQL
30	Trichloroethene	7	BQL
31	Trichlorofluoromethane	7	BQL
32	Vinyl chloride	14	BQL

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:	Roux Associates	AEN ID:	R119-075-01
Project:	06626M15	Sample:	SS-E4/4-6

Number	Compound	PQL ug/kg (dry)	Result ug/kg (dry)
Other TCL Compounds:			
33	Acetone	140	BQL
34	2-Butanone	140	BQL
35	Carbon disulfide	7	BQL
36	1,2-Dibromoethane	7	BQL
37	2-Hexanone	70	BQL
38	Methyl-t-butylether	7	BQL
39	4-Methyl-2-pentanone	70	BQL
40	Styrene	7	BQL
41	Vinyl Acetate	70	BQL
42	Xylenes (Total)	7	BQL

Surrogate Standard Recovery:

1,2-Dichloroethane-d4	87	%
Toluene-d8	84	%
Bromofluorobenzene	79	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Dilution factor adjusted for moisture content of sample.

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:	Roux Associates	AEN ID:	R119-075-02
Project:	06626M15	Sample:	GW-C2
Report Date	11/26/97	Type:	Water
Collected:	11/18/97	Container:	VOA
Received:	11/18/97		
Analyzed:	11/21/97	Dilution Factor:	5
By:	WJG		

Number	Compound	PQL (ug/L)	Result (ug/L)
1	Benzene	25	BQL
2	Bromodichloromethane	25	BQL
3	Bromoform	25	BQL
4	Bromomethane	50	BQL
5	Carbon tetrachloride	25	BQL
6	Chlorobenzene	25	BQL
7	Chloroethane	50	BQL
8	2-Chloroethylvinyl ether	25	BQL
9	Chloroform	25	BQL
10	Chloromethane	50	BQL
11	Dibromochloromethane	25	BQL
12	1,2-Dichlorobenzene	25	BQL
13	1,3-Dichlorobenzene	25	BQL
14	1,4-Dichlorobenzene	25	BQL
15	1,1-Dichloroethane	25	BQL
16	1,2-Dichloroethane	25	BQL
17	1,1-Dichloroethene	25	BQL
18	cis-1,2-Dichloroethene	25	BQL
19	trans-1,2-Dichloroethene	25	BQL
20	1,2-Dichloropropane	25	BQL
21	cis-1,3-Dichloropropene	25	BQL
22	trans-1,3-Dichloropropene	25	BQL
23	Ethylbenzene	25	BQL
24	Methylene chloride	25	69B
25	1,1,2,2-Tetrachloroethane	25	BQL
26	Tetrachloroethene	25	BQL
27	Toluene	25	BQL
28	1,1,1-Trichloroethane	25	BQL
29	1,1,2-Trichloroethane	25	BQL
30	Trichloroethene	25	BQL
31	Trichlorofluoromethane	25	BQL
32	Vinyl chloride	50	BQL

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:	Roux Associates	AEN ID:	R119-075-02
Project:	06626M15	Sample:	GW-C2

	Other TCL Compounds:	PQL (ug/L)	Result (ug/L)
33	Acetone	500	BQL
34	2-Butanone	500	BQL
35	Carbon disulfide	100	BQL
36	1,2-Dibromoethane	25	BQL
37	2-Hexanone	250	BQL
38	Methyl-t-butylether	25	BQL
39	4-Methyl-2-pentanone	250	BQL
40	Styrene	25	BQL
41	Vinyl Acetate	250	BQL
42	Xylenes (Total)	25	BQL

Surrogate Standard Recovery:

1,2-Dichloroethane-d4	95	%
Toluene-d8	105	%
Bromofluorobenzene	110	%

Comments:

PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Quantitation limit elevated due to sample dilution prior to analysis.
Dilution due to sample foaming.
B = Compound in blank

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:	Roux Associates	AEN ID:	R119-075-03
Project:	06626M15	Sample:	Trip Blank 11/18
Report Date:	11/26/97	Type:	Water
Collected:	11/18/97	Container:	VOA
Received:	11/18/97		
Analyzed:	11/26/97	Dilution Factor:	1
By:	WJG		

Number	Compound	PQL (ug/L)	Result (ug/L)
1	Benzene	5	BQL
2	Bromodichloromethane	5	BQL
3	Bromoform	5	BQL
4	Bromomethane	10	BQL
5	Carbon tetrachloride	5	BQL
6	Chlorobenzene	5	BQL
7	Chloroethane	10	BQL
8	2-Chloroethylvinyl ether	5	BQL
9	Chloroform	5	BQL
10	Chloromethane	10	BQL
11	Dibromochloromethane	5	BQL
12	1,2-Dichlorobenzene	5	BQL
13	1,3-Dichlorobenzene	5	BQL
14	1,4-Dichlorobenzene	5	BQL
15	1,1-Dichloroethane	5	BQL
16	1,2-Dichloroethane	5	BQL
17	1,1-Dichloroethene	5	BQL
18	cis-1,2-Dichloroethene	5	BQL
19	trans-1,2-Dichloroethene	5	BQL
20	1,2-Dichloropropane	5	BQL
21	cis-1,3-Dichloropropene	5	BQL
22	trans-1,3-Dichloropropene	5	BQL
23	Ethylbenzene	5	BQL
24	Methylene chloride	5	BQL
25	1,1,2,2-Tetrachloroethane	5	BQL
26	Tetrachloroethene	5	BQL
27	Toluene	5	BQL
28	1,1,1-Trichloroethane	5	BQL
29	1,1,2-Trichloroethane	5	BQL
30	Trichloroethene	5	BQL
31	Trichlorofluoromethane	5	BQL
32	Vinyl chloride	10	BQL

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:	Roux Associates	AEN ID:	R119-075-03
Project:	06626M15	Sample:	Trip Blank 11/18

	Other TCL Compounds:	PQL (ug/L)	Result (ug/L)
33	Acetone	100	BQL
34	2-Butanone	100	BQL
35	Carbon disulfide	20	BQL
36	1,2-Dibromoethane	5	BQL
37	2-Hexanone	50	BQL
38	Methyl-t-butylether	5	BQL
39	4-Methyl-2-pentanone	50	BQL
40	Styrene	5	BQL
41	Vinyl Acetate	50	BQL
42	Xylenes (Total)	5	BQL

Surrogate Standard Recovery:

1,2-Dichloroethane-d4	106	%
Toluene-d8	100	%
Bromofluorobenzene	116	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:		AEN ID:	Method Blank
Project:		Sample:	
Report Date:	11/26/97	Type:	Water
Collected:		Container:	
Received:			
Analyzed:	11/21/97	Dilution Factor:	1
By:	WJG		

Number	Compound	PQL (ug/L)	Result (ug/L)
1	Benzene	5	BQL
2	Bromodichloromethane	5	BQL
3	Bromoform	5	BQL
4	Bromomethane	10	BQL
5	Carbon tetrachloride	5	BQL
6	Chlorobenzene	5	BQL
7	Chloroethane	10	BQL
8	2-Chloroethylvinyl ether	5	BQL
9	Chloroform	5	BQL
10	Chloromethane	10	BQL
11	Dibromochloromethane	5	BQL
12	1,2-Dichlorobenzene	5	BQL
13	1,3-Dichlorobenzene	5	BQL
14	1,4-Dichlorobenzene	5	BQL
15	1,1-Dichloroethane	5	BQL
16	1,2-Dichloroethane	5	BQL
17	1,1-Dichloroethene	5	BQL
18	cis-1,2-Dichloroethene	5	BQL
19	trans-1,2-Dichloroethene	5	BQL
20	1,2-Dichloropropane	5	BQL
21	cis-1,3-Dichloropropene	5	BQL
22	trans-1,3-Dichloropropene	5	BQL
23	Ethylbenzene	5	BQL
24	Methylene chloride	5	11
25	1,1,2,2-Tetrachloroethane	5	BQL
26	Tetrachloroethene	5	BQL
27	Toluene	5	BQL
28	1,1,1-Trichloroethane	5	BQL
29	1,1,2-Trichloroethane	5	BQL
30	Trichloroethene	5	BQL
31	Trichlorofluoromethane	5	BQL
32	Vinyl chloride	10	BQL

AEN - Massachusetts
Analysis Report: EPA Method 8240B

Client:
Project:

AEN ID: Method Blank
Sample:

	Other TCL Compounds:	PQL (ug/L)	Result (ug/L)
33	Acetone	100	BQL
34	2-Butanone	100	BQL
35	Carbon disulfide	20	BQL
36	1,2-Dibromoethane	5	BQL
37	2-Hexanone	50	BQL
38	Methyl-t-butylether	5	BQL
39	4-Methyl-2-pentanone	50	BQL
40	Styrene	5	BQL
41	Vinyl Acetate	50	BQL
42	Xylenes (Total)	5	BQL

Surrogate Standard Recovery:

1,2-Dichloroethane-d4	96	%
Toluene-d8	105	%
Bromofluorobenzene	110	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Corresponding Samples: R119-075-02.

American Environmental Network, Inc.
149 Rangeway Road
N. Billerica, Massachusetts 01862
978/667-1400
Fax 978/667-7871

CHAIN OF CUSTODY RECORD

CUST. P.O. #

AEN QUOTE #

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ MCP GW1 ☐ MCP OTHER

☐ RCRA ☐ NIOSH ☒ OTHER

TURN AROUND

☐ 15 BUSINESS DAY
☐ 10 BUSINESS DAY
☐ RUSH
☒ OTHER See Comments

COMPANY	CONTACT PERSON	PROJECT I.D.	PHONE #	FAX #
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ADDRESS

[illegible]

CITY	STATE	ZIP
[illegible]	[illegible]	[illegible]

DATE	TIME	SAMPLE I.D.	MATRIX	CONTAINER TYPE	# OF CONTAINERS	PRESERVATIVES	REQUESTED PARAMETERS	(COMMENTS)
11/18	[illegible]	[illegible]	Soil	VOA	2	HCl	X	48-hr TAT
11/18	0940	[illegible]	W	VOA	2	HCl	X	7-day TAT
11/18	[illegible]	[illegible]	W	VOA	2	HCl	X	

SAMPLED BY: [illegible] [illegible] (PRINT NAME) (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY	DATE / TIME
[illegible]	11/18 1135		
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED FOR LAB BY	DATE / TIME
		[illegible]	11-18-98 1635

AEN USE ONLY

FIELD REMARKS

American Environmental Network
149 Rangeway Road • N. Billerica, MA 01862 • (978) 667-1400 • Fax (978) 667-7871

Mr. Larry McTurman
Roux Associates
13 Branch Street, Suite 13
Methuen, MA 01844

December 10, 1997

Dear Mr. McTurman:

Please find enclosed the analytical results of the sample(s) received at our laboratory on November 24, 1997. This report contains sections addressing the following information at a minimum:

- sample ID correspondence table
- analytical results
- chain-of-custody (if applicable)
- definitions of data qualifiers and terminology

Client Project #	06626M15	Client Project Name	N/A
IEA Report #	R119-076	Purchase Order #	N/A

Copies of this analytical report and supporting data are maintained in our files for a minimum of 3 years unless special arrangements are made. Unless specifically indicated, all analytical testing was performed at the IEA-Massachusetts laboratory.

We appreciate your selection of our services and welcome any questions or suggestions you may have relative to this report. Please contact your customer service representative at (978) 667-1400 for any additional information. Thank you for utilizing our services and we hope you will consider us for your future analytical needs.

I have reviewed and approved the enclosed data for final release.

Sincerely,

Michael F. Wheeler, Ph.D.
Laboratory Director

IEA/American Environmental Network (MA)
MA-DEP #MA038

MW/dlb

Sample ID Correspondence Table

Client Sample ID	IEA Sample ID
GW-EF4	R119-076-01
GW-F3	R119-076-02
Trip Blank	R119-076-03
SS-E6/2-4	R119-076-04
SS-F2/2-4	R119-076-05
SS-F2/4-6	R119-076-06
SS-M2/4-6	R119-076-07
GW-E6/FB	R119-076-08
GW-FG 2/FB	R119-075-09

SUBCONTRACT/INTERLABORATORY NOTIFICATION

Report Date:12/09/97
Client:Roux Associates
Project:06626M15

Received Date:11/24/97
AEN Job Number:R1119-076

A portion of the analytical work for this project was performed at another laboratory. Analytical methods conducted within the AEN Network are subject to uniform corporate quality control procedures. Non-network laboratories are selected on the basis of appropriate certification. The following parameters were analyzed at the indicated labs.

Subcontract Laboratory	Parameter
AEN - IL	EPA Method 8020

If you have any questions please call your client service representative.

Definitions of Data Qualifiers and Terminology

A number of data qualifiers are widely used within the environmental testing industry and may be utilized in our data reports. The following definitions of these qualifiers are included as a service to our clientele. The majority of the qualifiers have evolved from the EPA contract laboratory program (CLP).

B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to use caution when applying the results of this analyte.

BQL - Below Quantitation Limit indicates the compound was not detected in the sample above the practical quantitation limit.

D - Indicates the compound was diluted below the calibration range.

E - Indicates that the concentration of the specific compound exceeded the calibration range of the instrument for that particular analysis.

J - Indicates an estimated value. The compound is determined to be present in the sample based on GC/MS criteria, but the amount is less than the sample quantitation limit. IEA - MA GC/MS reports do not typically report J - marked results. If requested, J - marked results are provided and the report flagged to verify that the data was appropriately reviewed.

MDL - The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

NA - Not applicable or not available.

ND - Indicates the compound or analyte was not detected in the sample above the method detection limit or the practical quantitation limit for the particular analysis.

PQL - The practical quantitation limit is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine operating conditions.

AEN - Massachusetts
Analysis Report: EPA Method 8020A - Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-01
Project:	06626M15	Sample:	GW-EF4
Report Date:	12/02/97	Type:	Water
Collected:	11/22/97	Container:	VOA
Received:	11/24/97		
Analyzed:	11/30/97	Dilution Factor:	1
By:	LSB		

Number	Priority Pollutant Compounds	PQL (ug/L)	Result (ug/L)
1	Benzene	1	BQL
2	Chlorobenzene	1	BQL
3	1,2-Dichlorobenzene	1	BQL
4	1,3-Dichlorobenzene	1	BQL
5	1,4-Dichlorobenzene	1	BQL
6	Ethylbenzene	1	BQL
7	Toluene	1	BQL
8	Xylenes (Total)	1	BQL
9	Methyl-t-butylether	1	BQL

Surrogate Standard Recovery:

1,4-Difluorobenzene	81	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-02
Project:	06626M15	Sample:	GW-F3
Report Date:	12/02/97	Type:	Water
Collected:	11/21/97	Container:	VOA
Received:	11/24/97		
Analyzed:	12/01/97	Dilution Factor:	200
By:	LSB		

Number	Priority Pollutant Compounds	PQL (ug/L)	Result (ug/L)
1	Benzene	200	BQL
2	Chlorobenzene	200	BQL
3	1,2-Dichlorobenzene	200	BQL
4	1,3-Dichlorobenzene	200	BQL
5	1,4-Dichlorobenzene	200	BQL
6	Ethylbenzene	200	BQL
7	Toluene	200	19,000
8	Xylenes (Total)	200	BQL
9	Methyl-t-butylether	200	BQL

Surrogate Standard Recovery:

1,4-Difluorobenzene	106	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of target compounds present.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-03
Project:	06626M15	Sample:	Trip Blank
Report Date:	12/02/97	Type:	Water
Collected:	11/18/97	Container:	VOA
Received:	11/24/97		
Analyzed:	11/29/97	Dilution Factor:	1
By:	LSB		

Number	Priority Pollutan: Compounds	PQL (ug/L)	Result (ug/L)
1	Benzene	1	BQL
2	Chlorobenzene	1	BQL
3	1,2-Dichlorobenzene	1	BQL
4	1,3-Dichlorobenzene	1	BQL
5	1,4-Dichlorobenzene	1	BQL
6	Ethylbenzene	1	BQL
7	Toluene	1	BQL
8	Xylenes (Total)	1	BQL
9	Methyl-t-butylether	1	BQL

Surrogate Standard Recovery:

1,4-Difluorobenzene	82	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-04
Project:	06626M15	Sample:	SS-E6/2-4
Report Date:	12/09/97	Type:	Soil
Collected:	11/20/97	Container:	Glass
Received:	11/24/97		
Analyzed:	12/03/97	Dilution Factor:	1
By:	EL		

Number	Priority Pollutant Compounds	PQL (ug/kg dry)	Result (ug/kg dry)
1	Benzene	1	BQL
2	Ethylbenzene	2	BQL
3	Toluene	2	3
4	Xylenes (Total)	2	2
5	Methyl-t-butylether	2	BQL

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Dilution factor adjusted for moisture content of sample.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-05
Project:	06626M15	Sample:	SS-F2/2-4
Report Date:	12/09/97	Type:	Soil
Collected:	11/20/97	Container:	Glass
Received:	11/24/97		
Analyzed:	12/03/97	Dilution Factor:	1
By:	IL		

Number	Priority Pollutant Compounds	PQL (ug/kg dry)	Result (ug/kg dry)
1	Benzene	1	BQL
2	Ethylbenzene	2	BQL
3	Toluene	2	BQL
4	Xylenes (Total)	2	2
5	Methyl-t-butylether	2	BQL

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Dilution factor adjusted for moisture content of sample.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-06
Project:	00626M15	Sample:	SS-F2/4-6
Report Date:	12/09/97	Type:	Soil
Collected:	11/20/97	Container:	Glass
Received:	11/24/97		
Analyzed:	12/03/97	Dilution Factor:	1
By:	IL		

Number	Priority Pollutant Compounds	PQL (ug/kg dry)	Result (ug/kg dry)
1	Benzene	1	BQL
2	Ethylbenzene	2	BQL
3	Toluene	2	BQL
4	Xylenes (Total)	2	BQL
5	Methyl-t-butylether	2	BQL

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Dilution factor adjusted for moisture content of sample.

AEN - Massachusetts
Analysis Report: EPA Method 8020A - Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-07
Project:	06626M15	Sample	SS-M2/4-6
Report Date:	12/09/97	Type:	Soil
Collected:	11/20/97	Container:	Glass
Received:	11/24/97		
Analyzed:	12/03/97	Dilution Factor:	1
By:	IL		

Number	Priority Pollutant Compounds	PQL (ug/kg dry)	Result (ug/kg dry)
1	Benzene	1	BQL
2	Ethylbenzene	2	BQL
3	Toluene	2	BQL
4	Xylenes (Total)	2	BQL
5	Methyl-t-butylether	2	BQL

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.
Dilution factor adjusted for moisture content of sample.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID:	R119-076-08
Project:	06626M15	Sample:	GW-E6/FB
Report Date:	12/02/97	Type:	Water
Collected:	11/20/97	Container:	VOA
Received:	11/24/97		
Analyzed:	11/30/97	Dilution Factor:	1
By:	LSB		

Number	Priority Pollutant Compounds	PQL (ug/L)	Result (ug/L)
1	Benzene	1	BQL
2	Chlorobenzene	1	BQL
3	1,2-Dichlorobenzene	1	BQL
4	1,3-Dichlorobenzene	1	BQL
5	1,4-Dichlorobenzene	1	BQL
6	Ethylbenzene	1	BQL
7	Toluene	1	BQL
8	Xylenes (Total)	1	BQL
9	Methyl-t-butylether	1	BQL

Surrogate Standard Recovery:

1,4-Difluorobenzene	86	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.

AEN - Massachusetts
Analysis Report: EPA Method 8020A -Volatile Aromatics

Client:	Roux Associates	AEN ID	R119-076-09
Project:	06626M15	Sample:	GW-FG-2/FB
Report Date:	12/02/97	Type:	Water
Collected	11/20/97	Container:	VOA
Received:	11/24/97		
Analyzed:	11/30/97	Dilution Factor:	1
By:	LSB		

Number	Priority Pollutant Compounds	PQL (ug/L)	Result (ug/L)
1	Benzene	1	BQL
2	Chlorobenzene	1	BQL
3	1,2-Dichlorobenzene	1	BQL
4	1,3-Dichlorobenzene	1	BQL
5	1,4-Dichlorobenzene	1	BQL
6	Ethylbenzene	1	BQL
7	Toluene	1	BQL
8	Xylenes (Total)	1	BQL
9	Methyl-t-butylether	1	BQL

Surrogate Standard Recovery:

1,4-Difluorobenzene	84	%

Comments:
PQL = Practical quantitation limit.
BQL = Below quantitation limit.

American Environmental Network, Inc.
149 Rangeway Road
N. Billerica, Massachusetts 01862
978/667-1400
Fax 978/667-7871

CHAIN OF CUSTODY RECORD

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ MCP GW1 ☐ MCP OTHER ____
☐ RCRA ☐ NIOSH ☒ OTHER ____

REQUIRED

CUST P.O. # ____
AEN QUOTE # ____

TURN AROUND

☐ 15 BUSINESS DAY
☐ 10 BUSINESS DAY
☐ RUSH ____
☒ OTHER 24 Business Day

COMPANY	CONTACT PERSON	PROJECT I.D.	PHONE #	FAX #
Rowe Associates	Larry McTiernan	06626-M15	(978)687-2400	(978)685-2400

ADDRESS: 13 Branch St.

CITY	STATE	ZIP
Methuen	MA	01844

DATE	TIME	SAMPLE I.D.	MATRIX	CONTAINER TYPE	# OF CONTAINERS	PRESERVATIVES	VOC's USE EPA 8260									REQUESTED PARAMETERS	(COMMENTS)
11/22	1330	~~EDD~~ GW-EF4	Water	VOA		HCl	X										
11/21	1445	GW-F3	Water	VOA		HCl	X										
11/18	—	Trip Blank	Water	VOA		HCl	X										
11/20	0920	SS-E6/2-4	Soil	VOA		Ice	✓										
11/19	1045	SS-F2/2-4	Soil	VOA		Ice	✓										
11/19	1130	SS-F2/4-6	Soil	VOA		Ice	✓										
11/20	1510	SS-M2/4-6	Soil	VOA		Ice	✓										
11/20	0935	GW-E10/FB	Water	VOA		HCl	X										
11/20	0915	GW-FG2/FB	Water	VOA		HCl	X										

SAMPLED BY: Ann Farrell (PRINT NAME) Ann Farrell (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY	DATE / TIME
Ann Farrell	11/23/99 1010	[illegible]	11/24/99 10:00
RELINQUISHED BY (SIGNATURE)	**DATE / TIME**	**RECEIVED FOR LAB BY**	**DATE / TIME**

AEN USE ONLY

FIELD REMARKS

APPENDIX E

Ground-Water Analysis Report Prepared by
O'Reilly, Talbot & Okun Associates, Inc.

O'Reilly, Talbot & Okun
Associates, Inc.

Environmental • Safety • Health • Geotechnical Engineering

December 3, 1997

Ann Farrell
Roux Associates
13 Branch Street
Methuen, MA 01844

Dear Ann:

Enclosed is a summary report for the on-site analytical work conducted by O'Reilly, Talbot & Okun Associates, Inc. at the Industriplex Site. Should you have any questions or comments, please contact me.

Sincerely,

James Gagnon, PE, LSP
Sr. Environmental Specialist

293 Bridge Street • Suite 500 • Springfield, Massachusetts 01103
Phone (413) 788-6222 • Fax (413) 788-8830 • E-Mail oto413@aol.com

SUMMARY REPORT

GROUNDWATER HEADSPACE SCREENING
INDUSTRIPLEX SITE
WOBURN, MASSACHUSETTS

DECEMBER 1997

293 Bridge Street • Suite 500 • Springfield, Massachusetts 01103
Phone (413) 788-6222 • Fax (413) 788-8830 • E-Mail oto413@aol.com

CONFIDENTIAL

SUMMARY REPORT

GROUNDWATER HEADSPACE SCREENING
INDUSTRIPLEX
WOBURN, MASSACHUSETTS

INTRODUCTION

O'Reilly, Talbot & Okun Associates, Inc. was hired by the Industriplex Site Trust to conduct headspace screening for the presence of benzene and toluene in groundwater samples collected at the Industriplex site located in Woburn, Massachusetts. Groundwater samples were collected utilizing a Geoprobe technique by Roux Associates. The samples were analyzed for benzene and toluene utilizing a Hewlett Packard gas chromatograph; a detailed description of the analytical protocol is presented in the following sections. The testing was conducted on November 19 through November 22, 1997.

SUMMARY OF RESULTS

Analytical results are presented in Table 1. The groundwater sample locations and designations were provided by Roux Associates.

TABLE 1
ANALYTICAL RESULTS
CONCENTRATIONS IN GROUNDWATER

DATE: SAMPLE DESIGNATION	BENZENE	TOLUENE
11/19/97		
GW-C4	ND	ND
GW-A4	ND	ND
GW-E3	ND	ND
GW-F2	ND	ND
GW-I4	ND	ND
GW-M3	ND	ND
GW-M5	ND	ND
GW-FG2	ND	ND
11/20/97		
GW-C6	ND	ND
GW-I6	ND	ND
GW-K4	ND	ND
GW-L6	ND	ND
GW-M2 (18')	ND	ND
11/21/97		
GW-D4	ND	ND
GW-G3 (13'-15')	ND	20,000 µg/l
GW-F3 (24'-25' preserved)	ND	13,000 µg/l
GW-F3 (24'-25' unpreserved)	ND	19,000 µg/l
ESA-1	ND	<5 µg/l
ESA-2	ND	ND
11/22/97		
GW-M2 (25')	ND	2,400 µg/l
GW-E2 (25')	ND	5,400 µg/l
GW-F2 (25')	ND	ND
GW-E3 (25')	ND	ND
GW-I2 (14')	ND	50 µg/l
GW-EF4 (04')	ND	ND
ND = not detected Detection limit = 25 µg/l		

SAMPLE ANALYSIS

Groundwater samples collected by Roux Associates field personnel were analyzed on-site within several hours of collection utilizing a Hewlett Packard Model 5890II gas chromatograph equipped with a flame ionization detector. Peak integration was performed by a Hewlett Packard Model 3396B Integrator. The specific GC parameters and conditions were as follows:

Chromatographic Column:	J & W Scientific DB-1 0.53mm., 30 meter, 5.0 µ film thickness
Detector:	Flame Ionization
Oven Conditions:	100 °C isothermal
Detector Temperature:	250 °C
Injection Temperature:	200 °C
Carrier Gas:	Nitrogen @ approx. 15 cc/min.
Sample size:	0.5 ml

Groundwater samples in 40 ml VOA vials were placed in a room temperature (65 °F) waterbath to provide a consistent sample temperature. To created a headspace, ten milliliters of water were removed and the vial was agitated by hand for two minutes. A 0.5 ml headspace sample was drawn from through the septum utilizing a gas-tight syringe and was immediately injected into the chromatograph. Compounds were identified based on a comparison to retention times of standards.

To calibrate the chromatograph, a 10,000 µg/l standard of benzene and toluene was prepared from neat standards. Lower concentration standards were prepared by diluting the 10,000 µg/l standard. Aqueous calibration standards were placed into 40 ml VOA vials and were handled in the same manner as the groundwater samples. A zero standard was prepared utilizing de-ionized water.

Chromatograms for the standards and for the groundwater samples are attached.

Several of the groundwater samples exhibited foaming and effervescence during agitation, apparently as a result of a reaction between the hydrochloric acid preservative and compounds present in the groundwater samples. This "off-gassing" may have impacted the concentration of toluene present in the headspace of some groundwater samples.

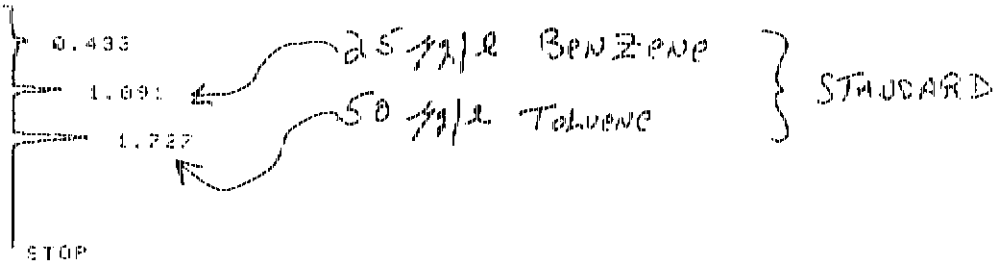
CONFIDENTIAL

CHROMATOGRAMS

RT	AREA	TYPE	WIDTH	AREA%
.436	1196	PB	.058	100.00000

TOTAL AREA= 1196
MUL FACTOR=1.0000E+00

* RUN # 23 NOV 19, 1997 13:44:21
START



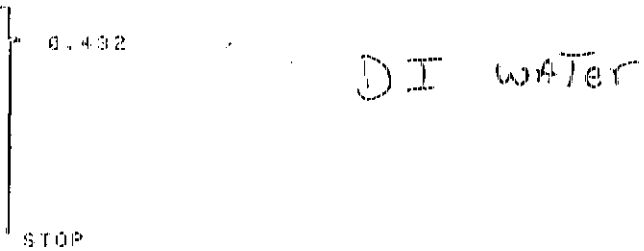
RUN# 23 NOV 19, 1997 13:44:21

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.433	1037	PV	.047	6.12956
1.091	5344	PB	.065	31.58766
1.727	10537	BB	.082	62.28277

TOTAL AREA= 16918
MUL FACTOR=1.0000E+00

* RUN # 24 NOV 19, 1997 13:50:35
START



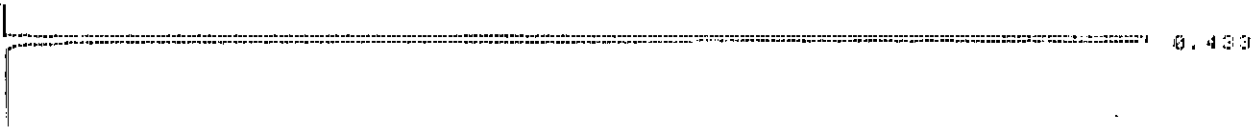
RUN# 24 NOV 19, 1997 13:50:35

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.432	1875	PV	.049	100.00000

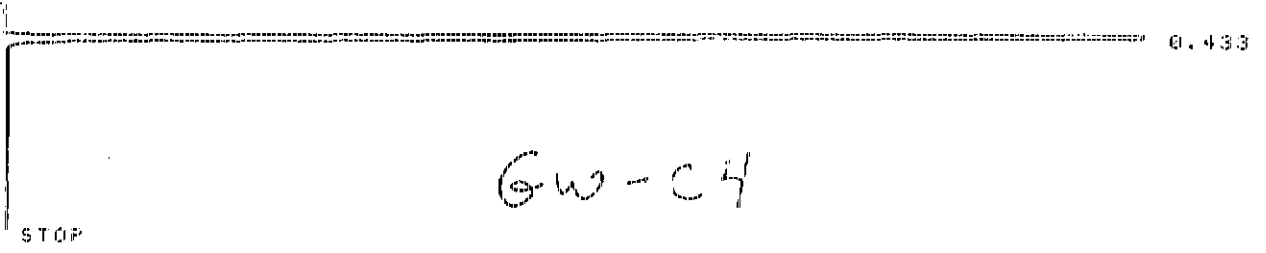
TOTAL AREA= 1875
MUL FACTOR=1.0000E+00

* RUN # 25 NOV 19, 1997 13:54:30
START



NUL FACTOR=1.0000E+00

* RUN # 25 NOV 19, 1997 13:54:30
START



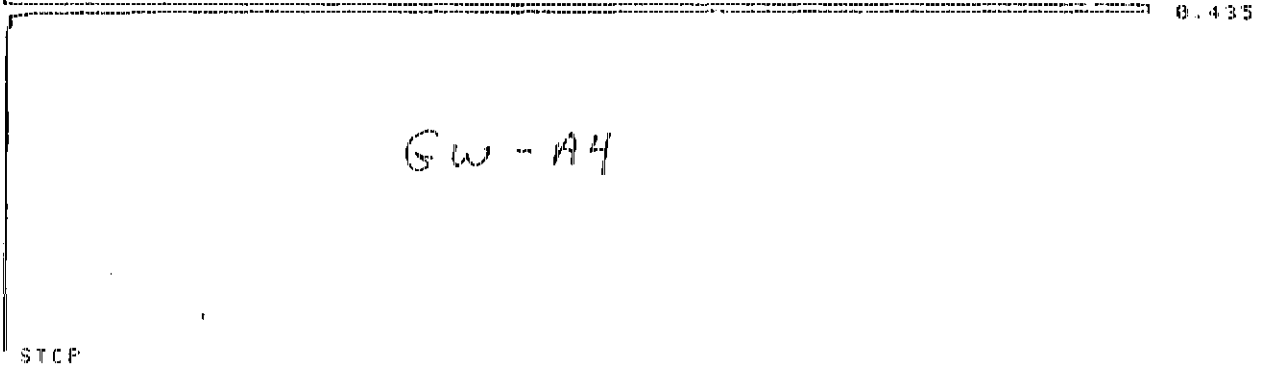
RUN# 25 NOV 19, 1997 13:54:36

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.433	1372178	PB	.051	100.00000

TOTAL AREA=1372178
NUL FACTOR=1.0000E+00

* RUN # 26 NOV 19, 1997 14:02:02
START



RUN# 26 NOV 19, 1997 14:02:02

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.435	5661363	PB	.052	100.00000

TOTAL AREA=5661363
NUL FACTOR=1.0000E+00

* RUN # 27 NOV 19, 1997 14:11:01
START

```
*  RUN #    27       NOV 19, 1997   14:11:01
START
                                                                                0.431
          0.821
          1.153
```

GW-E3

```
STOP
```

```
RUN#     27            NOV 19, 1997   14:11:01

AREAX
       RT        AREA  TYPE   WIDTH       AREAX
     .431     7717239    PB    .650    99.91597
     .821        4472    BP    .074     .05790
    1.153        2030    VV    .085     .02615

TOTAL AREA=7723722
MUL FACTOR=1.0000E+00
```

```
*  RUN #    28       NOV 19, 1997   14:17:51
START
                                                                                0.433
```

GW-F2

```
STOP
```

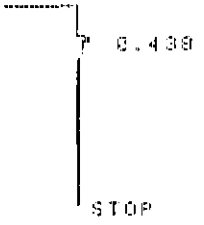
```
RUN#     28            NOV 19, 1997   14:17:51

AREAX
       RT        AREA  TYPE   WIDTH       AREAX
     .433     1175498    PB    .050   100.00000

TOTAL AREA=1175498
MUL FACTOR=1.0000E+00
```

```
*  RUN #    29       NOV 19, 1997   14:24:00
START
```

1.768	5142	PB	.004	49.21379

TOTAL AREA= 10665
MUL FACTOR=1.0000E+00

* RUN # 38 NOV 19, 1997 15:38:37
START



DI water

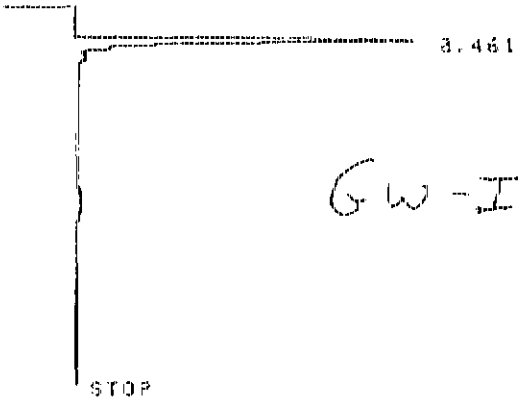
RUN# 38 NOV 19, 1997 15:38:37

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.438	1555	PV	.073	100.00000

TOTAL AREA= 1555
MUL FACTOR=1.0000E+00

* RUN # 39 NOV 19, 1997 15:42:06
START



GW-I4

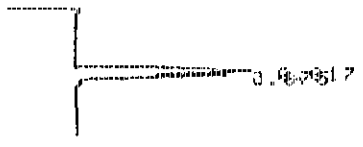
RUN# 39 NOV 19, 1997 15:42:06

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.461	41131	PV	.073	100.00000

TOTAL AREA= 41131
MUL FACTOR=1.0000E+00

* RUN # 40 NOV 19, 1997 15:51:06
START



STOP

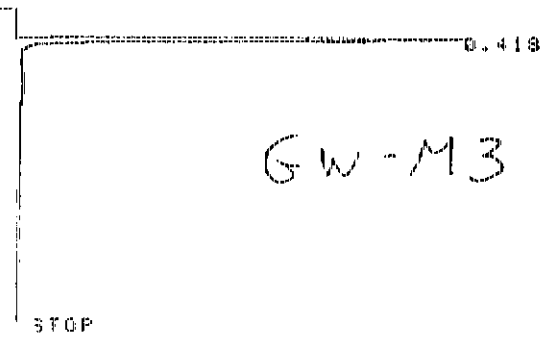
RUN# 41 NOV 19, 1997 15:57:40

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.382	2082	PV	.047	21.61545
1.051	2712	PB	.064	28.15614
1.667	4838	BB	.078	50.22840

TOTAL AREA= 9632
MUL FACTOR=1.0000E+00

* RUN # 42 NOV 19, 1997 16:02:40
START



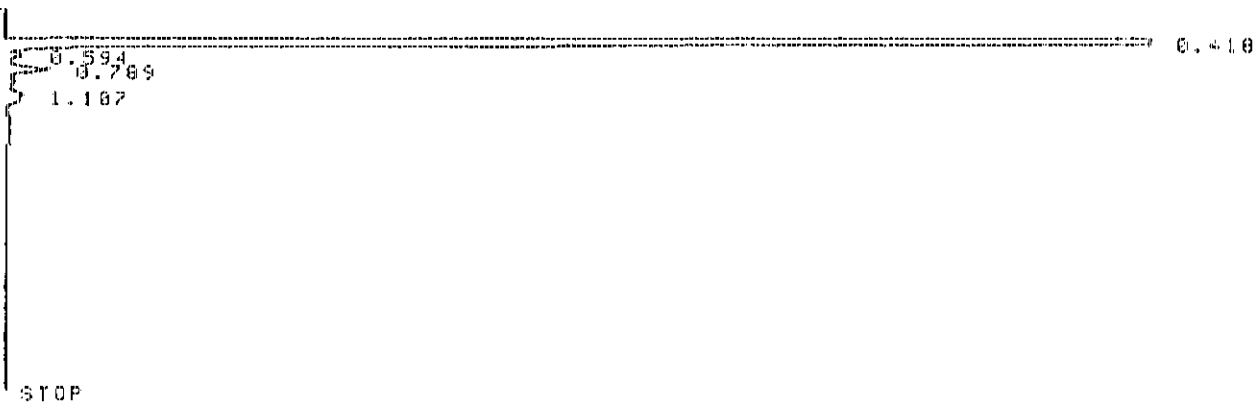
RUN# 42 NOV 19, 1997 16:02:40

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.418	35643	PB	.047	100.00000

TOTAL AREA= 35643
MUL FACTOR=1.0000E+00

* RUN # 43 NOV 19, 1997 16:07:38
START



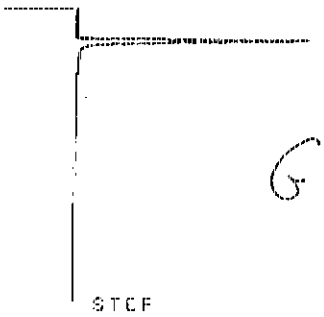
RUN# 43 NOV 19, 1997 16:07:38

AREAX

RT	AREA	TYPE	WIDTH	AREAX
.418	7976512	PB	.047	99.90611

TOTAL AREA= 13659
MUL FACTOR=1.0000E+00

* RUN # 47 NOV 19, 1997 16:26:28
START



GW-MS

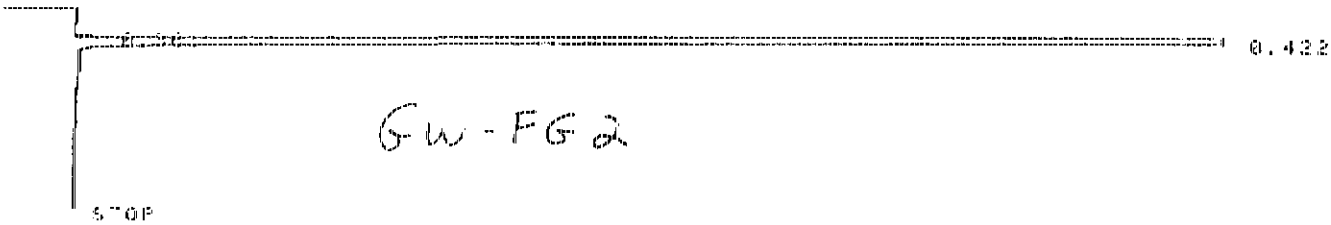
RUN# 47 NOV 19, 1997 16:26:28

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.419	19470	PB	.649	100.00000

TOTAL AREA= 19470
MUL FACTOR=1.0000E+00

* RUN # 48 NOV 19, 1997 16:31:32
START



GW-FG2

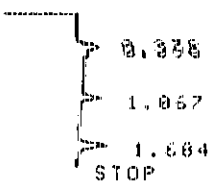
RUN# 48 NOV 19, 1997 16:31:32

AREA%

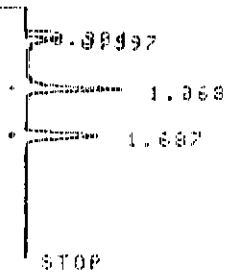
RT	AREA	TYPE	WIDTH	AREA%
.361	212	PP	.007	.01833
.422	1156535	PB	.047	99.98170

TOTAL AREA=.156747
MUL FACTOR=1.0000E+00

* RUN # 49 NOV 19, 1997 16:34:44
START



* RUN # 5 NOV 20, 1997 11:39:26
START



25 ppb Benzene
25 ppb Toluene
} STANDARD

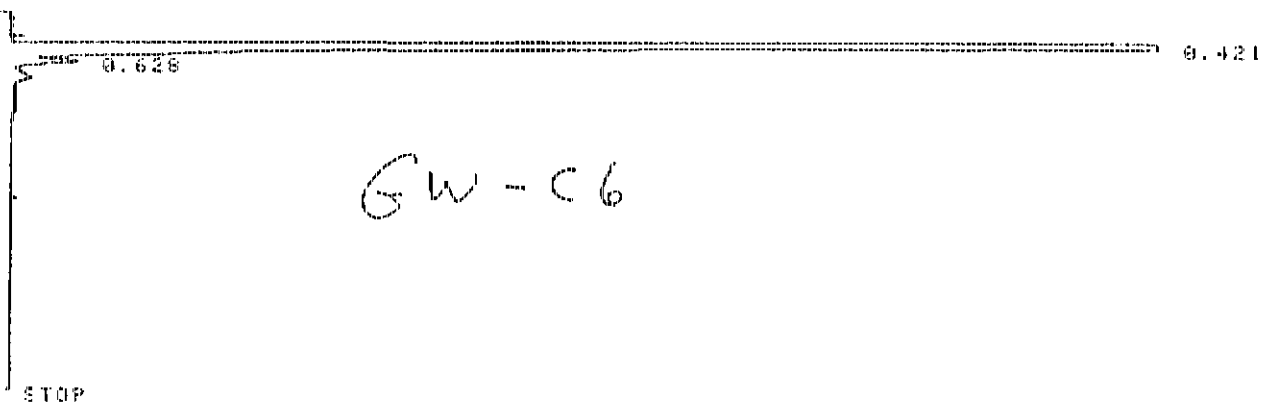
RUN# 5 NOV 20, 1997 11:39:26

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.304	121	PB	.305	.91639
.397	1321	BV	.349	10.00454
1.068	6452	PB	.080	48.86398
1.687	5318	BB	.085	40.21509

TOTAL AREA= 13208
MUL FACTOR=1.0000E+00

* RUN # 6 NOV 20, 1997 11:47:04
START



GW-C6

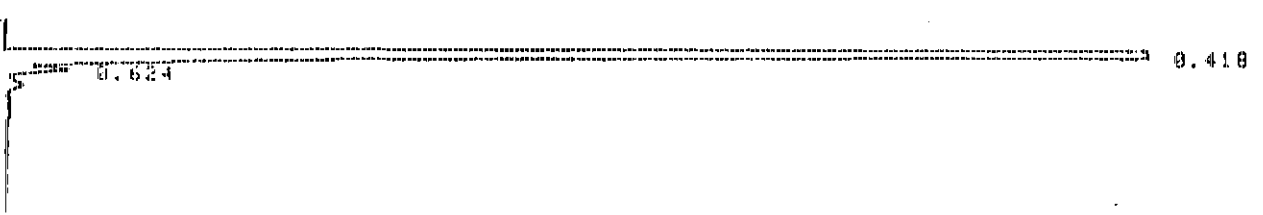
RUN# 6 NOV 20, 1997 11:47:04

AREA%

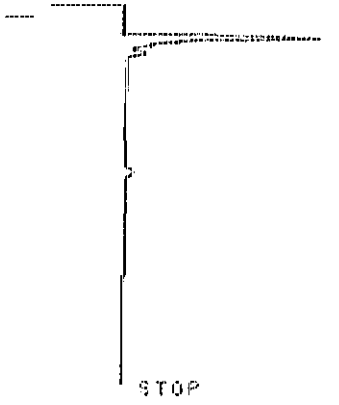
RT	AREA	TYPE	WIDTH	AREA%
.421	665157	PB	.052	99.63958
.628	2406	BP	.059	.36042

TOTAL AREA= 667563
MUL FACTOR=1.0000E+00

* RUN # 7 NOV 20, 1997 11:57:12
START



* RUN # 8 NOV 26, 1997 12:27:59
START



GW-I6

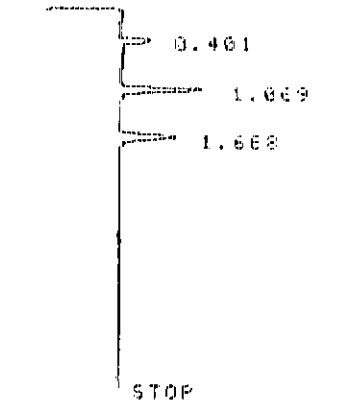
RUN# 8 NOV 26, 1997 12:27:59

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.446	10479	PV	.063	100.00000

TOTAL AREA= 10479
NUL FACTOR=1.0000E+00

* RUN # 9 NOV 28, 1997 12:34:34
START



RUN# 9 NOV 28, 1997 12:34:34

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.401	1522	BV	.060	14.67979
1.069	4793	BB	.068	46.10339
1.668	4066	BB	.083	39.21683

TOTAL AREA= 10368
NUL FACTOR=1.0000E+00

* RUN # 10 NOV 28, 1997 12:48:32
START

0.462

STOP

RUN# 10 NOV 20, 1997 12:40:32

AREA%

RT	AREA TYPE	WIDTH	AREA%
.462	39136 PB	.055	100.00000

TOTAL AREA= 39136
MUL FACTOR=1.0000E+00

*

* RUN # 11 NOV 20, 1997 12:49:49
START

0.449

GW-K4

STOP

RUN# 11 NOV 20, 1997 12:49:49

AREA%

RT	AREA TYPE	WIDTH	AREA%
.449	6634 PV	.076	100.00000

TOTAL AREA= 6634
MUL FACTOR=1.0000E+00

*

** LOOP DOWN: TIMEOUT **

Configuring, Wait for "LOOP UP" message

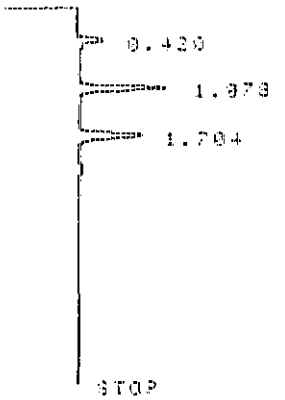
<<<<<<<<<<<<<< LOOP UP >>>>>>>>>>>>>>

* RUN # 12 NOV 20, 1997 13:05:10
START

P* 0.420

1.666

1.687



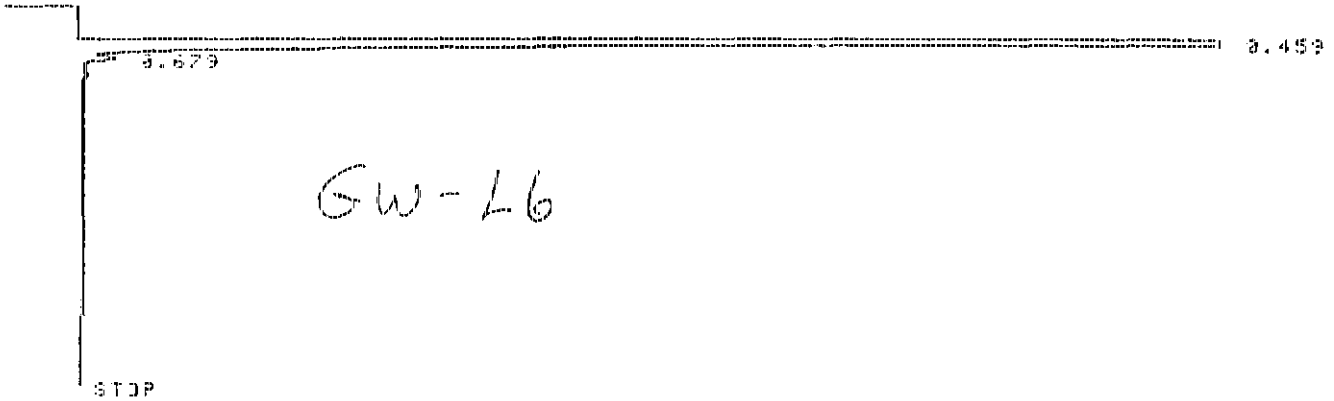
RUN# 15 NOV 20, 1997 14:36:24

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.430	1652	PB	.071	13.93858
1.678	5309	BB	.672	44.79413
1.704	4891	PB	.688	41.26730

TOTAL AREA= 11852
MUL FACTOR=1.0000E+00

* RUN # 16 NOV 20, 1997 15:25:45
START



GW-16

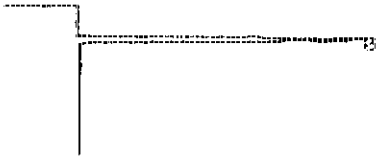
RUN# 16 NOV 20, 1997 15:25:45

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.459	1875799	PB	.051	99.93248
.679	1267	BP	.062	.06750

TOTAL AREA=1877066
MUL FACTOR=1.0000E+00

* RUN # 17 NOV 20, 1997 15:14:52
START



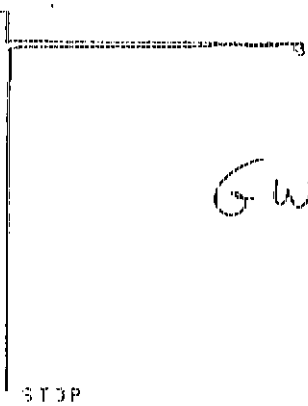
RUN# 16 NOV 20, 1997 15:25:45

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.459	1875799	PB	.051	99.93248
.679	1267	BP	.062	.06750

TOTAL AREA=1877066
MUL FACTOR=1.0000E+00

* RUN # 17 NOV 20, 1997 16:14:52
START



GW-M2 (18')

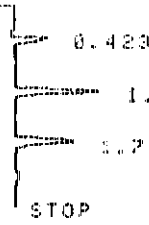
RUN# 17 NOV 20, 1997 16:14:52

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.421	13870	PB	.051	100.00000

TOTAL AREA= 13870
MUL FACTOR=1.0000E+00

* RUN # 18 NOV 20, 1997 16:20:39
START



RUN# 18 NOV 20, 1997 16:20:39

AREA%

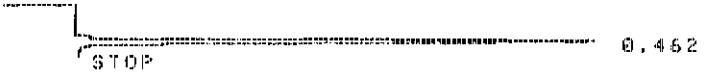
RUN# 2 NOV 21, 1997 12:33:27

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.421	1043	PV	.027	2.24123
.464	27400	VV	.029	58.87790
.490	18094 I	VH	.025	38.88090

TOTAL AREA= 46537
MUL FACTOR=1.0000E+00

* RUN # 3 NOV 21, 1997 12:33:32
START



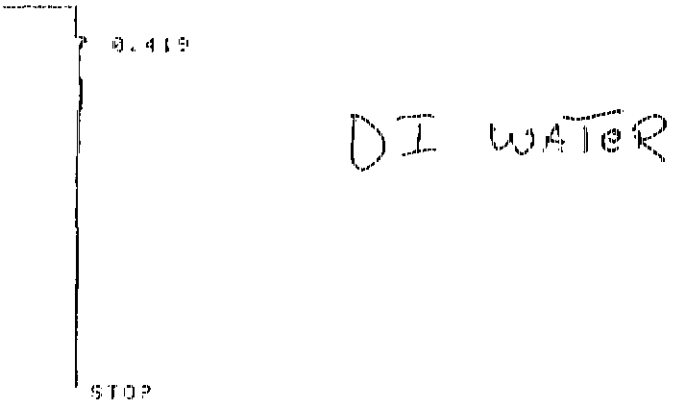
RUN# 3 NOV 21, 1997 12:33:32

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.462	45155	PB	.052	100.00000

TOTAL AREA= 45155
MUL FACTOR=1.0000E+00

* RUN # 4 NOV 21, 1997 12:37:37
START



RUN# 4 NOV 21, 1997 12:37:37

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.419	972	BV	.056	100.00000

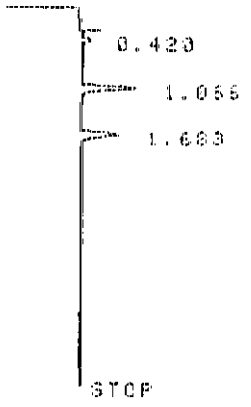
TOTAL AREA= 972
MUL FACTOR=1.0000E+00

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.419	972	EV	.056	100.00000

TOTAL AREA= 972
MUL FACTOR=1.0000E+00

* RUN # 5 NOV 21, 1997 12:44:41
START



25 ug/L Benzene } STANDARD
25 ug/L Toluene }

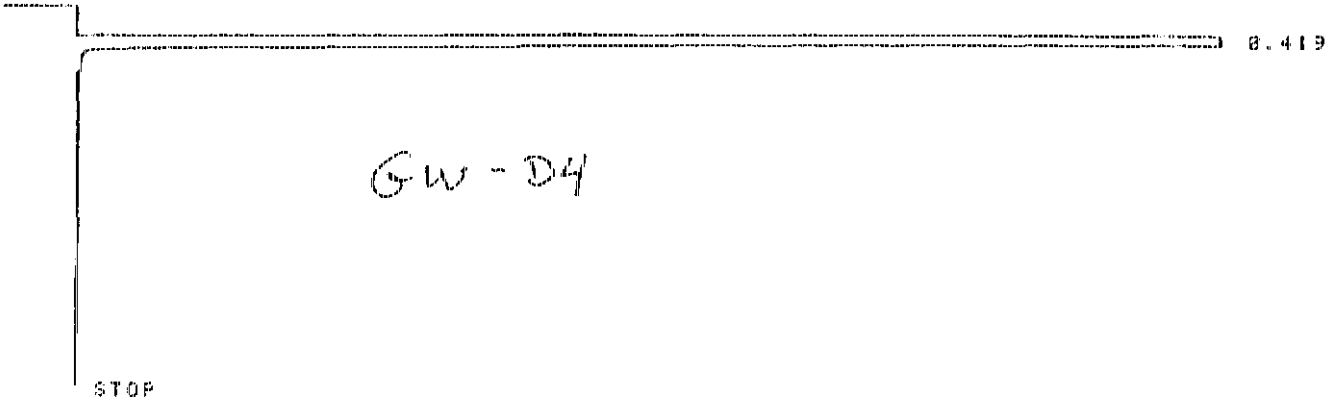
RUN# 5 NOV 21, 1997 12:44:41

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.420	923	PV	.051	7.32947
1.066	6115	BB	.066	48.55874
1.683	5555	BB	.083	44.11181

TOTAL AREA= 12593
MUL FACTOR=1.0000E+00

* RUN # 6 NOV 21, 1997 12:54:28
START



GW-D4

RUN# 6 NOV 21, 1997 12:54:28

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.419	10582160	PB	.054	100.00000

TOTAL AREA=1.0582E+07
MUL FACTOR=1.0000E+00

RUN# 13 NOV 21, 1997 14:58:49

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.464	22036	PV	.039	50.04090
.490	21307	VB	.031	49.15982

TOTAL AREA= 43343
MUL FACTOR=1.0000E+00

* RUN # 14 NOV 21, 1997 15:00:22
START

0.120

0.490

STOP

RUN# 14 NOV 21, 1997 15:00:22

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.120	3950	BB	.081	8.42810
.463	16868	PV	.023	35.99122
.498	26049	VB	.035	55.58069

TOTAL AREA= 46867
MUL FACTOR=1.0000E+00

* RUN # 15 NOV 21, 1997 15:02:22
START

0.415

0.845

1.692

GW-63

STOP

RUN# 15 NOV 21, 1997 15:02:22

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.415	9928954	PB	.050	72.50156
.845	1221	PB	.050	.00892
1.592	3764653	PB	.085	27.48959

TOTAL AREA=1.3695E+07
MUL FACTOR=1.0000E+00

* RUN # 16 NOV 21, 1997 15:06:53
START

```
*  RUN #    23      NOV 21, 1997  15:44:35
START
        0.425
                                                                  1.086
                                                                  1.711
        STOP
```

10,000 µg/L BENZENE
10,000 µg/L TOLUENE
} STANDARD

```
RUN#     23            NOV 21, 1997  15:44:35

AREA%
       RT        AREA  TYPE   WIDTH       AREA%
     .425        1303    PV    .057     .044445
    1.086     2066501    PB    .069    50.95062
    1.711     1987586    PB    .087    49.00493

TOTAL AREA=4055890
MUL FACTOR=1.0000E-06


*  RUN #    24      NOV 21, 1997  15:50:34
START: not ready
        0.400
              0.780
                    1.094


        2.637

        STOP


RUN#     24            NOV 21, 1997  15:50:34

AREA%
       RT        AREA  TYPE   WIDTH       AREA%
     .400         994    PV    .052     2.10418
     .780       11248    VB    .071    24.71599
    1.094       28224    BB    .074    62.01650
    2.637        5043    PB    .176    11.08132

TOTAL AREA=  45509
MUL FACTOR=1.0000E-06


*  RUN #    25      NOV 21, 1997  15:57:03
START: not ready
                                                        0.470
```

STOP

RUN# 21 NOV 21, 1997 15:30:19

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.466	16071	PV	.023	37.10776
.491	27233	VB	.037	62.89224

TOTAL AREA= 43303
MUL FACTOR=1.0000E+00

* RUN # 22 NOV 21, 1997 15:34:30
START

0.412

0.838

1.687

GW-F3 (preserved)

4.650
STOP

RUN# 22 NOV 21, 1997 15:34:30

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.412	23520672	PB	.042	89.70310
.333	981	PP	.052	.00391
1.687	2573324	PB	.034	10.24952
4.650	10918 I	BH	.619	.04349

TOTAL AREA=2.5106E+07
MUL FACTOR=1.0000E+00

* RUN # 23 NOV 21, 1997 15:44:35
START

0.425

1.085

1.711

STOP

RUN# 23 NOV 21, 1997 15:44:35

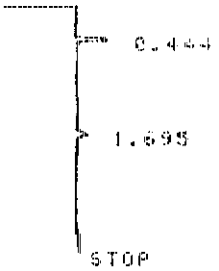
AREA%

RT	AREA	TYPE	WIDTH	AREA%
.425	1393	PV	.657	.04445

RT	AREA	TYPE	WIDTH	AREA%
.445	301938	PB	.049	100.00000

TOTAL AREA= 301938
MUL FACTOR=1.0000E+00

* RUN # 32 NOV 21, 1997 16:32:35
START



ESA - 1

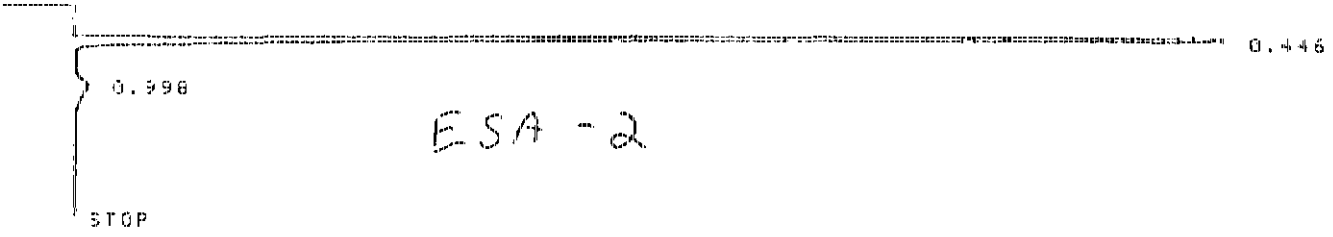
RUN# 32 NOV 21, 1997 16:32:35

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.444	2615	PP	.048	57.75178
1.695	1913	BB	.083	42.24822

TOTAL AREA= 4528
MUL FACTOR=1.0000E+00

* RUN # 33 NOV 21, 1997 16:37:23
START



ESA - 2

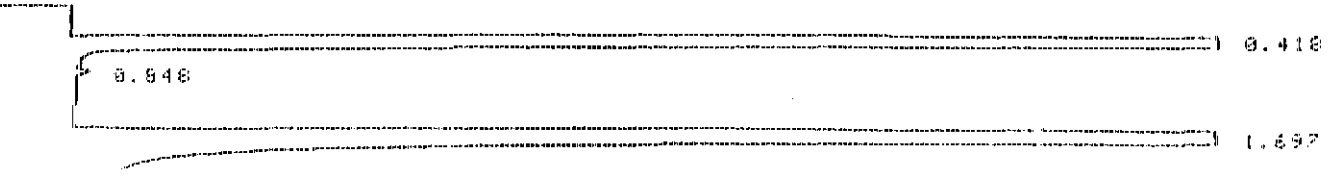
RUN# 33 NOV 21, 1997 16:37:23

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.446	291432	PB	.050	98.15830
.998	5468	BP	.264	1.84170

TOTAL AREA= 296900
MUL FACTOR=1.0000E+00

* RUN # 34 NOV 21, 1997 16:41:11
START



```
*  RUN #    34      NOV 21, 1997  16:41:11
START
                                                                    0.418
        0.846
                                                                    1.697
        STOP
```

GW-F3 (unpreserved)

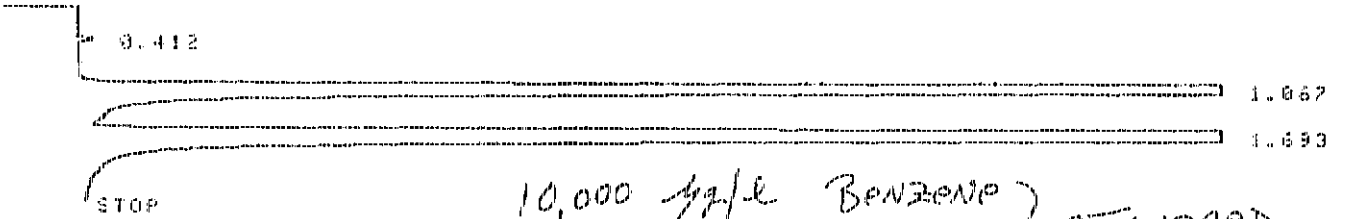
```
RUN#     34           NOV 21, 1997  16:41:11

AREA%
       RT        AREA  TYPE   WIDTH       AREA%
     .418   45341536    PB    .046    92.36515
     .848        1475    PP    .058     .00300
    1.697    3746434    PB    .085    7.63186

TOTAL AREA=4.9089E+07
MUL FACTOR=1.0000E+00


*  RUN #    35      NOV 21, 1997  16:46:04
START
        0.449
                                                                    1.083
                                                                    1.703
        STOP


RUN#     35           NOV 21, 1997  16:46:04

AREA%
       RT        AREA  TYPE   WIDTH       AREA%
     .449        1622    PP    .045     .06216
    1.083     1523932    PB    .064   58.40357
    1.703     1083759    PB    .084   41.53427

TOTAL AREA=2609314
MUL FACTOR=1.0000E+00


*  RUN #    36      NOV 21, 1997  16:50:49
START: not ready
                                                                    0.494
        STOP


RUN#     36           NOV 21, 1997  16:50:49

AREA%
       RT        AREA  TYPE   WIDTH       AREA%
     .494       40477    PB    .052  100.00000

TOTAL AREA=  40477
```

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.420	1429	PV	.058	100.00000

TOTAL AREA= 1429
MUL FACTOR=1.0000E+00

* RUN # 5 NOV 23, 1997 11:30:26
START



10,000 µg/L Benzene
10,000 µg/L Toluene
} STANDARD

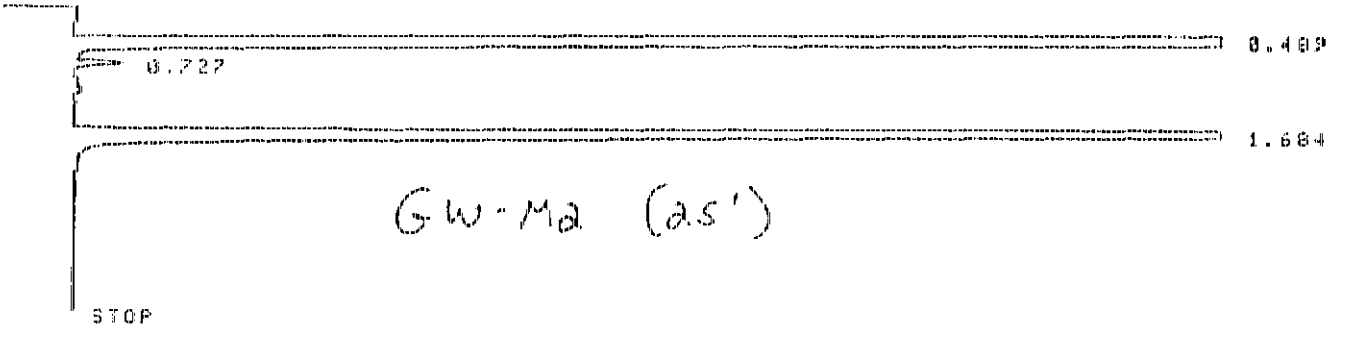
RUN# 5 NOV 22, 1997 11:30:26

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.412	1364	BP	.053	.03570
1.667	1984617	PB	.071	51.93896
1.693	1835076	PB	.090	48.02534

TOTAL AREA=3821058
MUL FACTOR=1.0000E+00

* RUN # 6 NOV 22, 1997 11:27:45
START



GW-Mw (2.5')

RUN# 6 NOV 22, 1997 11:27:45

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.409	15496616	PV	.022	48.62422
.437	15944336	VB	.029	50.02906
.727	4305	PB	.056	.01351
1.684	424985	PB	.083	1.33324

TOTAL AREA=3.1870E+07
MUL FACTOR=1.0000E+00

* RUN # 7 NOV 22, 1997 11:32:31

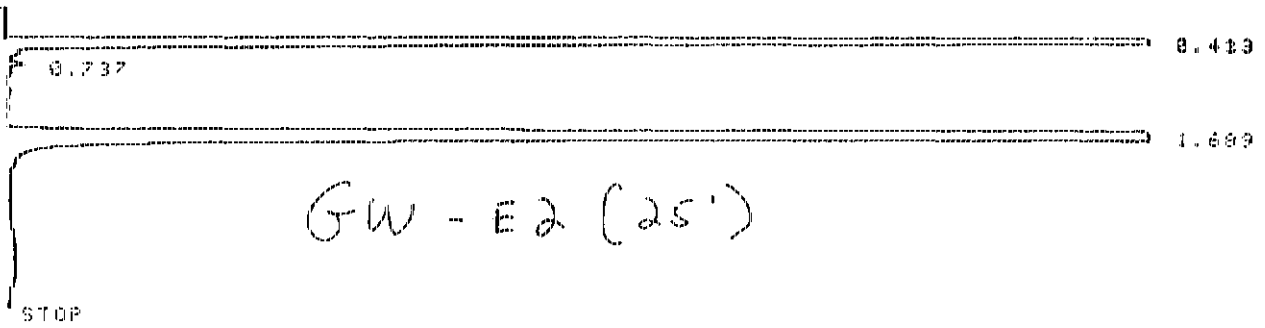
RUN# 8 NOV 22, 1997 11:41:04

AREAS

RT	AREA	TYPE	WIDTH	AREAX
.412	2664181	PB	.052	72.95440
.741	1432	PV	.054	.03888
1.688	986243	PB	.065	27.00673

TOTAL AREA=3651843
MUL FACTOR=1.0000E+00

* RUN # 9 NOV 22, 1997 11:45:40
START



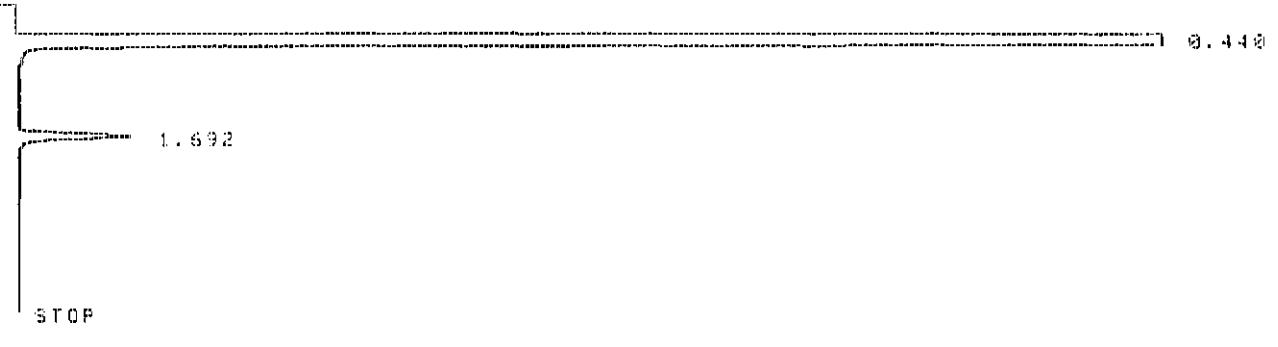
RUN# 9 NOV 22, 1997 11:45:40

AREAS

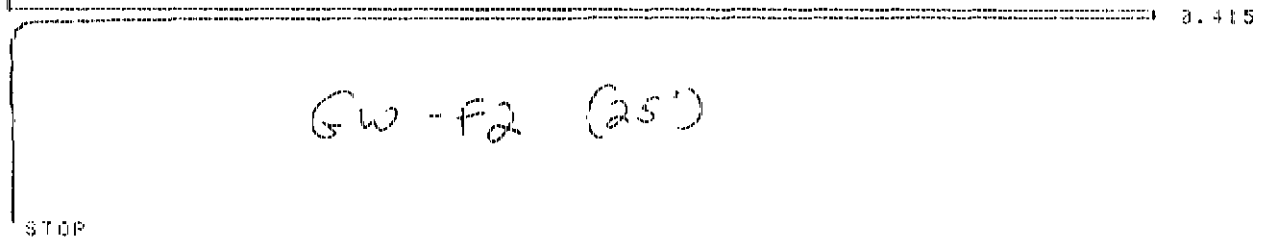
RT	AREA	TYPE	WIDTH	AREAX
.413	1229411	PV	.025	33.83118
.438	1406873	VB	.027	38.71459
.737	1452	PV	.057	.03996
1.689	996223	PB	.093	27.41426

TOTAL AREA=3633958
MUL FACTOR=1.0000E+00

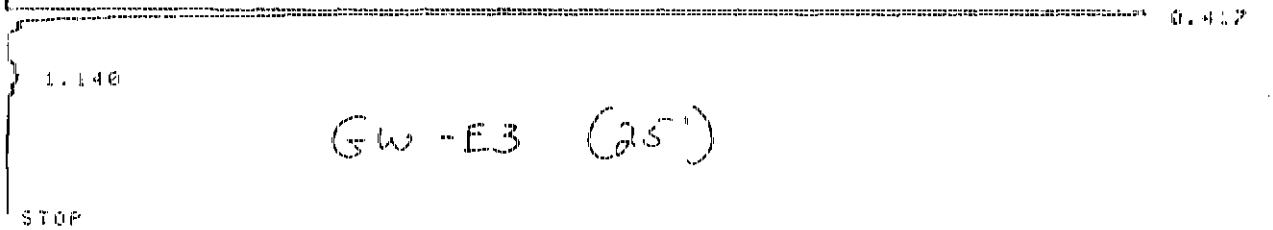
* RUN # 10 NOV 22, 1997 11:51:11
START



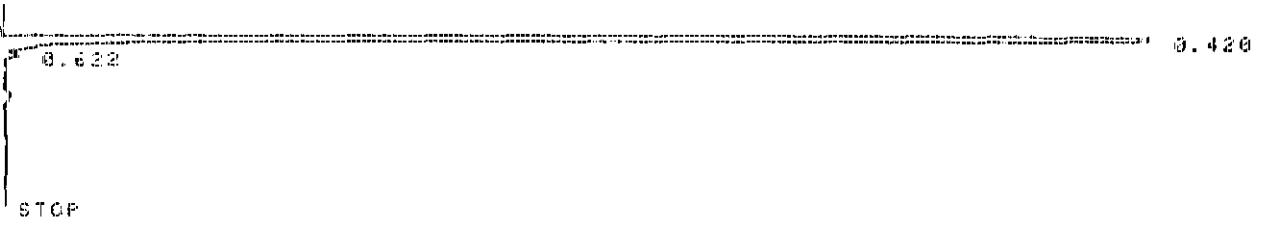
```
*  RUN #    17      NOV 22, 1997   12:20:42
START
```




```
RUN#     17            NOV 22, 1997   12:20:42

AREA%
       RT       AREA TYPE   WIDTH       AREA%
     .415   28043816    PB    .038   100.00000

TOTAL AREA=2.8044E+07
MUL FACTOR=1.0000E+00


*  RUN #    18      NOV 22, 1997   12:25:15
START
```




```
RUN#     18            NOV 22, 1997   12:25:15

AREA%
       RT       AREA TYPE   WIDTH       AREA%
     .417     246300    PB    .847    97.16896
    1.140       7176    PV    .364     2.83104

TOTAL AREA= 253475
MUL FACTOR=1.0000E+00


*  RUN #    19      NOV 22, 1997   12:29:02
START
```




```
RUN#     19            NOV 22, 1997   12:29:02
```

STOP

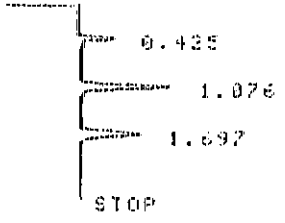
RUN# 19 NOV 22, 1997 12:29:02

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.420	242599	PB	.047	99.53250
.622	1164	BP	.060	.47751

TOTAL AREA= 243763
MUL FACTOR=1.0000E+00

* RUN # 20 NOV 22, 1997 12:32:16
START



50 ng/L Benzene
50 ng/L Toluene
} STANDARD

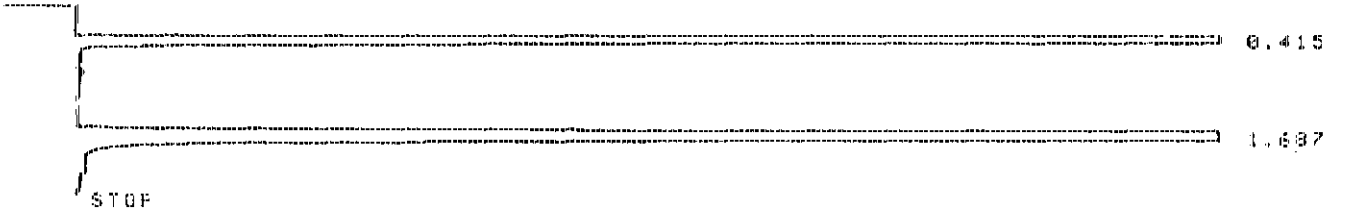
RUN# 20 NOV 22, 1997 12:32:16

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.425	2778	PB	.048	12.81010
1.076	10318	BB	.069	47.57989
1.697	8590	BB	.083	39.61002

TOTAL AREA= 21686
MUL FACTOR=1.0000E+00

* RUN # 21 NOV 22, 1997 12:38:35
START; rc1 ready

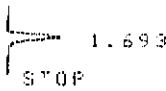


RUN# 21 NOV 22, 1997 12:38:35

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.415	9919411	PB	.048	91.11053
1.697	967816	PB	.083	8.88947

TOTAL AREA=1.0887E+07
MUL FACTOR=1.0000E+00



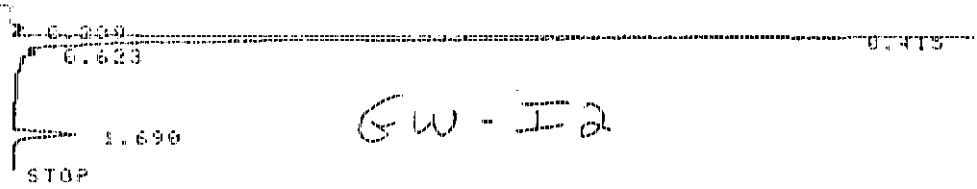
RUN# 26 NOV 22, 1997 13:07:24

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.411	88599	PB	.055	89.69507
.998	2027	BB	.060	2.05208
1.693	8152	PB	.088	8.25285

TOTAL AREA= 98778
MUL FACTOR=1.0000E+00

* RUN # 27 NOV 22, 1997 13:10:46
START



GW - I2

RUN# 27 NOV 22, 1997 13:10:46

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.289	394	PB	.037	.05872
.415	91945	BV	.056	88.31610
.623	2521	VV	.074	2.42150
1.698	8749	BB	.083	8.40369

TOTAL AREA= 104109
MUL FACTOR=1.0000E+00

* RUN # 28 NOV 22, 1997 13:18:06
START

RUN# 28 NOV 22, 1997 13:18:36

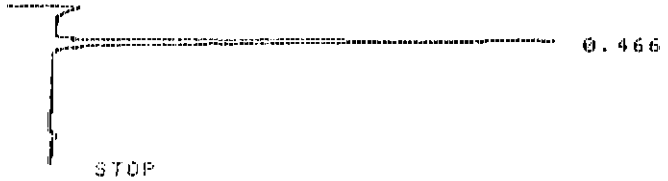
AREA%

RT	AREA	TYPE	WIDTH	AREA%
.413	13388616	PV	.023	45.37592
.441	16114992	VB	.029	54.61600
1.691	2387	PB	.089	.00809

TOTAL AREA=2.9506E+07
MUL FACTOR=1.0000E+00

NUL FACTOR=1.0000E+00

* RUN # 32 NOV 22, 1997 13:34:23
START



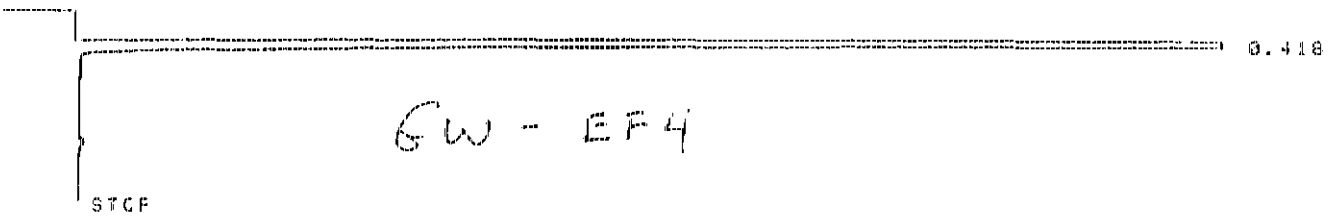
RUN# 32 NOV 22, 1997 13:34:23

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.466	43695	BB	.051	100.00000

TOTAL AREA= 43695
NUL FACTOR=1.0000E+00

* RUN # 33 NOV 22, 1997 13:37:11
START



6w - EF4

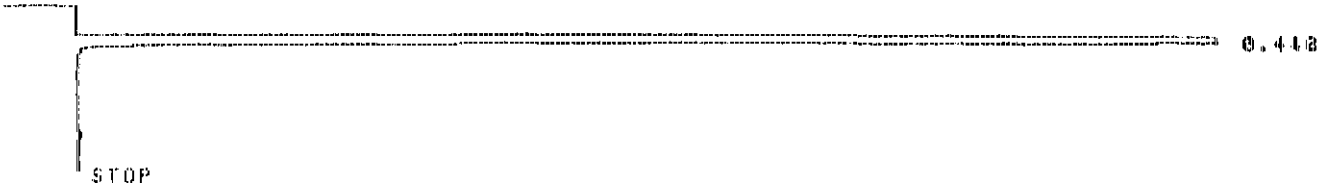
RUN# 33 NOV 22, 1997 13:37:11

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.418	1416569	PB	.048	100.00000

TOTAL AREA=1416569
NUL FACTOR=1.0000E+00

* RUN # 34 NOV 22, 1997 13:40:49
START



RUN# 34 NOV 22, 1997 13:40:49

AREA%

RT	AREA	TYPE	WIDTH	AREA%
.412	669395	PV	.026	46.51939
.440	769564	VB	.029	53.48062